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Annual Report
of the
Department of Agriculture in the Province of Bombay, 1939-40

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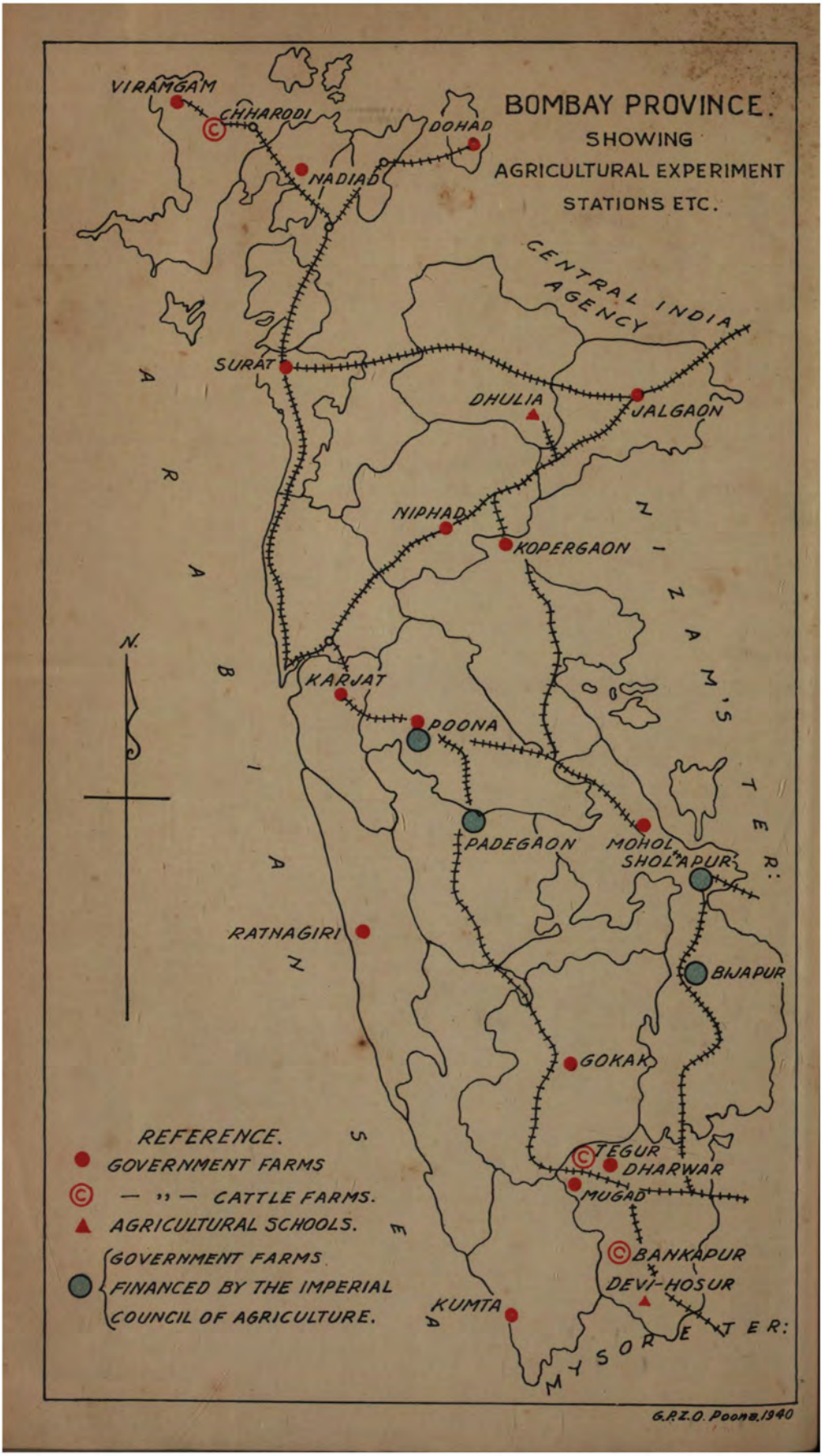

G.P.I.O. Poona. 1940

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ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, BOMBAY PROVINCE, 1939-1940.

CHAPTER I.

Features of the Year.

CLIMATE AND RAINFALL.

(1) (*a*) *The Agricultural Year, 1939-40.*—The year 1939-40, from the agricultural stand-point, was fair over the greater part of the Province, but judged by crop results, it was less satisfactory than the preceding one. The outstanding features of the season were prolonged breaks in the rains during the crop-growing period and the unduly early cessation of the monsoon. Rainfall in June was deficient while the precipitation received in July and August was inadequate, irregular and unevenly distributed both as regards periodicity of fall and area. There was a prolonged drought from about the middle of July till the middle of August. This check in the monsoon resulted in a serious set-back to *kharif* crops which, in many places, were severely retarded in growth as a result. Accordingly, crop prospects in the early part of the season were uncertain, especially in North Gujarat and the eastern regions of the South Deccan and the Karnatak. In some areas of these tracts crops failed wholly or partially and scarcity conditions were apprehended. The opportune and welcome rains which occurred in the latter half of August and in the first fortnight of September over almost the entire Province, relieved the situation appreciably, in many tracts saving crops from complete failure. These rains also facilitated and expedited *rabi* sowings and gave promise of a successful *rabi* season. Unfortunately, the inadequacy and sporadic nature of later rains, combined with other adverse factors, such as, the prevalence of dry easterly winds, occasional cloudy weather conditions, increased incidence of insect pests and plant diseases, etc., falsified these hopes and resulted in a reduction of crop outturns in most areas. Accordingly, as a whole, the season under review may be termed disappointing over large tracts of the Province especially in the northern areas of Gujarat and the eastern parts of the South Deccan and the Karnatak where prolonged and untimely breaks in rains resulted in deterioration of crops and scarcity of water and fodder in many areas.

(2) (*b*) *Crop statistics—areas.*—Reviewing all crops together, there has been little alteration in the total area sown in the Province as compared with the preceding decennium. The area under rice was 7·7 per cent. and 5·9 per cent., respectively, below the area of last year and the average of the preceding ten years. The wheat area showed a reduction of 9·4 per cent. and 0·6 per cent., respectively, below the acreages of the preceding year and the decennial average. The acreages sown with *jowar* and *bajri* were, respectively, 4·1 per cent. and 0·1 per cent. above the areas sown during last season and 15·4 per cent. above the decennial average in the case of *bajri* but 0·8 per cent. below the average of the preceding ten years in the case of *jowar*.

The area under groundnut represented some 5·6 per cent. and 42·6 per cent., respectively, more than the previous year's acreage and the decennial average and reached the record figure of 1,515,893 acres. The cotton acreage remained almost the same as last year being only 0·6 per cent. above the figure of the preceding year but showed a decrease of 6·5 per cent. when compared with the acreage of last ten years.

Sugarcane area recorded a considerable increase. The total area under this crop during the year under report amounted to 100,090 acres against 76,120 acres during the preceding year or 31·6 per cent. and 42·2 per cent., respectively, above the last year's acreage and the average of past decennium. The table below gives the actual acreage in the Province under the more important crops in the year under report, i.e. 1939–40, the preceding year 1938–39 and the average acreage of the decennium 1928–29 to 1937–38 :—

No.	Name of the crop.	Acreage in Bombay Province.		
		1939–40.	1938–39.	Average of decennium 1928–29 to 1937–38.
	Cereals.	Acres.	Acres.	Acres.
1	Rice	1,860,474	2,015,329	1,977,281
2	Wheat	1,686,055	1,860,583	1,696,895
3	*Jowari*	8,041,627	7,728,308	8,105,332
4	*Bajri*	4,258,227	4,252,517	3,688,603

No.	Name of the crop.	Acreage in Bombay Province.		
		1939-40.	1938-39.	Average of decennium 1928-29 to 1937-38.
	Fibres.	Acres.	Acres.	Acres.
5	Cotton	3,721,799	3,698,757	3,982,232
	Pulses.			
6	Gram	517,242	595,036	661,636
7	*Tur*	408,946	449,850	393,775
	Oilseeds.			
8	Groundnut	1,515,893	1,435,638	1,063,025
9	Sesamum	158,253	209,945	183,281
10	Linseed	123,235	124,777	125,327
11	Castorseed	40,526	45,927	58,983
	Miscellaneous.			
12	Sugarcane	100,090	76,120	70,377
13	Tobacco	183,285	155,060	151,819

(3) (*c*) *Crop statistics—production.*—Due to the unfavourable climatic rainfall conditions noted above, there was a considerable reduction in the estimated production of crops. The yield of rice went down by as much as 15·3 per cent. and 23·3 per cent., respectively, below the yield of the previous year and the decennial average. The corresponding figures of reduction in the case of *jowar* were 5·6 per cent. and 21·1 per cent., respectively. The total estimated outturn of wheat was less by 7·8 per cent. than in the previous year but 2·4 per cent. more than the average of the preceding decennium. The yield of *bajri* was 4·7 per cent. and 0·2 per cent., respectively, below that of last year and the decennial average.

The outturn of groundnut worked out to 5·5 per cent. below the last year's figure but 12·6 per cent. above the figure of the decennial average. The cotton crop yielded 3·9 per cent. more than in the previous year but the yield was less only by 5·2 per cent. when compared with the average of the past ten years.

The production of *gul* during the year under report indicated an increase over that in the previous year and also over the decennial average, respectively, by 33·8 per cent. and 37·4 per cent. in sympathy with the increase in the acreage under sugarcane.

The table below gives the yields in the Province of the more important crops in the year under report, i.e., 1939–40, the preceding year 1938–39 and the average yield of the decennium 1928–29 to 1937–38 :—

No.	Name of the crop.	Production of crops in Bombay Province.		
		1939–40.	1938–39.	Average of decennium 1928–29 to 1937–38.
	Cereals.	Tons.	Tons.	Tons.
1	Rice	668,011	788,848	870,937
2	Wheat	310,628	337,088	303,273
3	*Jowari*	1,246,769	1,320,131	1,579,679
4	*Bajri*	477,620	501,032	478,651
	Fibres.	Bales. (400 lbs.)	Bales. (400 lbs.)	Bales. (400 lbs.)
5	Cotton	679,305	653,879	716,771
	Pulses.	Tons.	Tons.	Tons.
6	Gram	77,667	90,597	105,477
7	*Tur*	99,185	112,760	104,523
	Oilseeds.			
8	Groundnut	549,827	581,760	488,234
9	Sesamum	14,622	22,286	21,693
10	Linseed	12,316	12,379	12,911
11	Castorseed	4,355	5,925	7,661
	Miscellaneous.			
12	Sugarcane (*Gul*)	254,272	190,098	185,082
13	Tobacco	36,032	30,300	34,874

The reduction in the total output of principal food crops resulted in shortage of fodder for cattle and this was particularly in evidence in the drought affected areas of North Gujarat and the south-eastern parts of the Province.

(4) (*d*) *Crop prices.*—Owing to uncertain conditions of rainfall and other adverse factors resulting in low crop yields and on account of the effects of the war, the prices of agricultural produce at principal centres in the Province exhibited an appreciable improvement over last year. Due to speculation, there were sharp variations in prices at the outset of the war but the price control orders promulgated by Government exercised a salutary influence over the market and helped to maintain prices at a satisfactory level.

The prices of both food and cash crops prevailing at harvest time were dearer than in the preceding year, except those of rice which remained stationary. The actual fluctuations in prices of different agricultural produce between the period July 1939 to June 1940 at the most important places in the Province are detailed below.

The price of rice at Thana was higher than in the previous year being at Rs. 5–7–4 per maund in June 1940 against Rs. 5–5–1 in July 1939. The wheat price at Ahmedabad was at Rs. 3–12–11 per maund in July 1939 and rose to Rs. 5–2–7 in December 1939 and to Rs. 5–5–4 in January 1940 but fell steadily to Rs. 4–6–2 per maund in June 1940. Likewise the price of *jowar* at Sholapur rose from Rs. 2–9–10 per maund in July 1939 to Rs. 3–4–11 in December 1939 and to Rs. 3–7–6 in January 1940 but subsequently came down to Rs. 2–8–1 per maund in June 1940. The rate of *bajri* at Nasik varied from Rs. 3–10–8 per maund in July 1939 to Rs. 4–1–11 in June 1940. It rose to Rs. 4–3–9 per maund in December 1939 and March 1940 and remained steady at Rs. 4–1–11 per maund from April onwards. The groundnut price at Karad, district Satara, ruled at Rs. 3–1–0 per maund in July 1939 but rose up to Rs. 3–4–0 in June 1940. It had risen to Rs. 4–10–0 per maund in December 1939 but continued to rule at Rs. 3–4–0 from February 1940 onwards.

The price of Broach Cotton ruling at Bombay indicated some fluctuations during the year under report. It remained at about Rs. 163 per *khandi* (784 lbs.) in August 1939 and rose to Rs. 182 in September 1939. In January-February 1940 the price of cotton ruled as high as Rs. 267 but steadily came down in the subsequent months and was ruling at Rs. 173 per *khandi* in July 1940.

The *gul* price though favourable in the early part of the season, i.e., since July to December 1939, showed a drop from January 1940 and fell abnormally from February onwards. At Poona, the average harvest price of *gul* dropped down from Rs. 8–3–0 per maund in 1939 to Rs. 4–11–0 per maund in 1940. The fall in price may be attributed to the increase in the acreage of sugarcane and in the production of *gul* in India as a whole in 1939–40.

(5) (*e*) *Agricultural legislation.*—During the year under report, several legislative measures of importance to agriculturists were passed by the Bombay Legislature. These include the Bombay Agricultural Debtors Relief Act, 1939, which provides for the establishment and working of machinery for the relief of agricultural debtors in the Province, the Bombay Tenancy Act, 1939, adopting measures for the protection of agricultural tenants, fixation of reasonable rent to protected tenants and the maintenance of certain rights to such tenants and the Bombay Fodder and Grain Control Act, 1939, which controls and regulates the supply and distribution of fodder and grain, including the regulation of prices thereof, on occasions of famine and scarcity. In addition, steps were taken through the Bombay Agricultural Produce Markets Act, 1939, to provide for the better regulation of buying and selling of agricultural produce in the Province by the establishment of regulated markets under the control of market committees upon which the primary producers should be adequately represented.

CHAPTER II.

AGRICULTURAL RESEARCH.

(6) *Introduction.*—Scientific research work towards a higher standard in the methods and material of agricultural practice in the Province continues to be the most important function of the Agricultural Department. As mentioned in last year's report, a review of the position of agricultural research was made at a meeting of scientific research workers of the Department in May 1939, and, as the outcome of that meeting, a publication entitled "Summary of the present position of agricultural research in Bombay Province with suggestions for the extension of such work in future" has now been issued by the Director of Agriculture. During the year under report, much progress has been made both in the expansion of research work already in progress and in the initiation of new schemes for scientific investigation into important agricultural problems on the lines suggested in the publication referred to above. Another important result of the review of scientific work which was undertaken last year has been the formation of expert departmental committees, with the Director of Agriculture as Chairman, to meet and consider periodically the progress made by scientific officers in their work and to discuss and lay down the programme for further extension and development of agricultural research in its different aspects. The committees already established deal with (*a*) insect pests and plant diseases, (*b*) fodder and livestock, (*c*) fruit and vegetables, (*d*) plant breeding and (*e*) agricultural engineering and land development. Meetings of all these committees were held during the year and they have been found to be most useful in co-ordinating scientific research work in the Province and in stimulating and guiding research workers. In addition, the Provincial Board of Agricultural Research met in June 1940 and considered eleven schemes of agricultural research dealing with such diverse subjects as extension of sheep-breeding and wool analysis, scientific botanical work on the *jowar* and rice crops, the establishment of a Central Grass Experimental Station, "model projects" for the extension of agricultural improvements on cultivators' lands, grass-drying and the expansion of dry farming research work. The Board recommended all the schemes, with slight modifications in some instances, to the Imperial Council of Agricultural Research.

(7) In this chapter of the Annual Report, the main items of scientific research work carried out by the staff of the Agricultural Department can only be very briefly reviewed. In many cases, such work is being done with the financial assistance of the Imperial Council of Agricultural Research, the Indian Central Cotton Committee and the Sir Sassoon David Trust Fund. Details of the subventions received for this purpose from these bodies are given in paragraph (83) of the Report. More detailed accounts of scientific research work carried out during the year will be found in the Appendices to the Report. The first Section of this Chapter deals with major fundamental research, connected mainly with soil and irrigation problems and centred at the Sugarcane Research Station, Bombay-Deccan, Padegaon, and at the Dry Farming Research Station, Sholapur and Bijapur. Other Sections deal briefly with the improvement of crops in all its aspects, livestock research work, horticultural research, investigations into the prevention and control of insect pests and plant diseases and miscellaneous research work, including agricultural engineering, etc. A brief account is given of new research schemes sanctioned by contributing bodies during the year, in some of which work has already been commenced.

Section A.

Soil and Irrigation Research.

A. *The Bombay Deccan Sugarcane Research Scheme, Padegaon.*

(8) This Scheme, which is financed jointly by the Provincial Government and the Imperial Council of Agricultural Research, was extended for a period of three years from June 1937. The year under report is the last year of this extension but a further extension of two years, i.e., till June 1942, has been sanctioned. The work under the Scheme is very comprehensive and embraces scientific investigation into all aspects of sugarcane cultivation in the Bombay-Deccan. In the Soil Physics Section, the work of genetic soil survey of the areas in the six major canal systems in the Bombay-Deccan has now reached its final stage and the information thus obtained is being utilised to devise suitable specific systems of agricultural practice for cane cultivation on each major soil type. As a necessary sequel to this work, a scheme for large-scale soil survey and mapping in the Canal tracts has been prepared and sanctioned. Soil fertility surveys conducted in the Godavari Canal area indicate that cane-growing not only improves the physical conditions of the soil but also adds considerably to the fertility constituents, e.g., nitrogen and available phosphoric acid. Considerable progress has been made with the classification of "degraded" or alkali soils including the devising of laboratory methods of testing their suitability for perennial irrigation. Modified methods of cane cultivation based upon these investigations have given promising results in field trials on different factory areas. Studies on crop rotations with sugarcane have been carried a stage further and work on alternative green manure crops has confirmed the superiority of the wild legume *patada shevra* (Desmodium diffusum) over other better known green manure crops in sugarcane cultivation. The work of the Crop Physiology Section has included the critical and statistical study of the mass of data of meteorological factors and their correlation with plant growth, which have been maintained since the opening of the Research Station. The beneficial effects of increased atmospheric humidity have been confirmed as also the deleterious effect of high temperatures causing excessive evaporation although heavy irrigation is effective in maintaining a higher humidity and lower temperatures inside the cane field, its beneficial effect in this

direction is more than counteracted by the leaching down of nitrates, résulting in early flowering. Work on the study of the inter-relationships of irrigation and manuring has confirmed previous findings and new systems of irrigation technique are under investigation. Bio-chemical research in the mineral nutrition of the cane crop is in progress to elucidate factors upon which manuring for higher tonnage and better sucrose content must be based. The application of potash manures at the time of earthing up of cane has been found to reduce pith formation. It has been found that the use of molasses alone as a manurial application to cane is definitely ineffective and it is necessary to take measures to neutralize the acidity resulting from such applications to secure any practical advantage.

The Agricultural Management Section continued its investigations into irrigation and manurial techniques of cane growing, using for this purpose important improved cane varieties. These experiments have now been modified in the light of results obtained from previous work and standardized on the lines recommended by the Manurial Sub-Committee of the Imperial Council of Agricultural Research. The relative importance of compost, cake and inorganic manures in cane cultivation, the optimum proportions and the optimum times of application of these three types of manures are under investigation. In addition, work on the improvement of cultural methods, e.g., by wider spacing and different methods and periods of planting, is yielding important results. Varietal trials of sugarcane, which were continued as usual during the year, indicate that the varieties Co : 428 and Co : 443 are promising although not superior to Co : 419. A scheme for the establishment of five sub-stations for additional experimental work on different soil types with regard to varieties of cane and irrigation and manurial technique has been sanctioned.

A separate staff is engaged on research work on the major insect pests of sugarcane in accordance with an all-India investigation into this subject, financed by the Imperial Council of Agricultural Research.

B. *The Bombay Dry Farming Research Scheme, Sholapur and Bijapur.*

(9) The year under report represents the seventh year of the working of this scheme of scientific research into the problems of crop production in scarcity or famine areas of the

Bombay-Deccan. The expenditure on the scheme is met jointly by the Imperial Council of Agricultural Research and the Provincial Government.

At Sholapur, the agricultural season of 1939–40 proved to be one of the driest seasons experienced in the past thirty years, the total rainfall amounting to 13·86 inches only which is about half the normal precipitation for the Sholapur tract. At Bijapur, however, the total rainfall was 22·79 inches which approximates closely to the normal for that area.

Soil investigations were continued at the Sholapur centre and the results obtained in soil moisture determinations throughout the season emphasized the inadequacy of the rainfall obtained for normal crop production. Even under the improved dry-farming methods, very poor yields of grain were obtained from the *jowar* crop which, in cultivators' fields, was a complete failure. The yield of straw per acre was doubled in the areas cultivated under the improved system in comparison with the local methods of tillage. Murum disintegration studies at Sholapur indicated progressive increase in the surface soil layer under the dry-farming method of cultivation.

At Bijapur, where the rainfall was satisfactory and well-distributed, the yields of *jowar* grain under the system of cultivation evolved at the Research Station were double those obtained by local cultivators. A similar increase was noted in the yield of *kadbi*. Experiments to determine the extent of run-off of rainfall from the soil were continued at both Sholapur and Bijapur. At the former station, such run-off was negligible on account of the excessively low total precipitation received. At Bijapur, however, run-off totalled 3·61 inches during the season with a loss of approximately 9½ tons of silt per acre.

Physiological studies of the *jowar* plant were continued at both stations and work was also done to determine the water requirements of the *jowar* and *bajri* crops. Manurial experiments at Sholapur were negatived by the abnormally low rainfall conditions but previous results on the beneficial effects of manuring, as an integral part of the dry-farming method, were confirmed on both the heavy and limy types of soil at Bijapur.

During the year under report, the improved dry-farming system of cultivation was applied with considerable success to cotton as a rotation crop with *jowar*. The increase in yield over the local methods of cultivation in the same area amounted to nearly 90 per cent.

Section B.

The Improvement of Crops.

A. COTTON.

(10) (*a*) *Gujarat.*—Scientific work on the improvement of the cotton crop in Gujarat is centred at the Government Research Stations at Surat, Broach and Viramgam. The experimental work under the Cotton Breeders at these centres is designed to produce still better strains of cotton which at present form the commercial crop in these areas and to evolve types which will give higher returns per acre to the cotton-growers. The main objects of the research work are increase in yield and ginning percentage, greater resistance to plant diseases and better quality of lint over the local varieties.

(11) At Surat, research work with the purpose of producing an improved cotton variety which would possess the high spinning value of the existing improved type 1027 A.L.F. and which, at the same time, would excel that improved variety in yield and ginning percentage, was continued. One improved strain, known as Seg. 8-1, represents the nearest approach to the desired improvement which has yet been reached and is now being tested on cultivators' fields along with 1027 A.L.F. and 1 A.L.B., the latter being a serious competitor of 1027 A.L.F. on account of its high ginning percentage although it is definitely inferior in lint quality. Further scientific work, both by selection and hybridization, is being carried on and certain promising material has been retained for further study. Work on breeding wilt-resistant types of cotton is also in progress at Shera near Ankleshwar.

(12) The Broach Cotton Breeding Scheme, which is financed by the Indian Central Cotton Committee, is now on its eighth season. The main object of this research work is to evolve a highly wilt-resistant, high ginning, high spinning and better yielding type of cotton to replace the inferior quality, wilt susceptible but high ginning cottons now being cultivated over eight lakhs of acres in the Nerbudda-Mahi Zone of the Broach tract. Eleven segregates from crosses and back crosses between B.D. 8 and other selected strains were tested under randomized replication field trials during the year and certain of these segregates, notably, segregates 76-1, 1-2 and 1-6, were most promising. These will now be tried out on cultivators' lands in the district.

(13) At Viramgam, scientific botanical improvement is being carried on with the financial assistance of the Indian Central Cotton Committee under the Wagad Cotton Breeding Research

Scheme. The object of this work is to improve upon the existing Dholleras-Wagad cotton with regard to (*a*) yield and quality, (*b*) earliness in maturity so as to minimize risk of loss from frost damage and (*c*) to replace the local Mathio cotton with Wagad. During the year under report, the botanical work had to be carried out on a leased plot under irrigation on account of the failure of the rains throughout the Wagad tract. The work of botanical selection among the local Wagad varieties was continued and three selections, viz., 115, 126 and N 89-2, were found to be promising and will now be tested against other improved strains and the local cotton in replicated field experiments. Fresh selections have also been made among local Wagad cottons and Wagad samples obtained from Cutch State. In addition, hybridization experiments involving crosses and back-crosses between Wagad cottons and the improved varieties 1027 A.L.F. and B.D. 8, were carried a stage further and segregates have been obtained which are satisfactory with regard to yield and ginning percentage. The botanical problem of cotton improvement in this area is one of great complexity and the main aim to be kept in view is the production of an improved variety which will give a greater monetary return per acre to the cotton-growers over a number of years. Russian types of cotton are being utilised in hybridization work in order to introduce the character of earliness.

(14) (*b*) *Khandesh.*—The Khandesh Cotton Breeding Research Scheme has now completed the third year of its five year extension period. As a result of previous work under this Scheme at Jalgaon, the improved variety of cotton known as Jarila was obtained and is now extending rapidly in general cultivation in the Khandesh districts. The continuance of botanical work aims at the improvement of the yield and ginning percentage of Jarila cotton without sacrificing any of the wilt-resistant character for which that improved variety is renowned. Work in the direction of further selection among Verum cottons and in hybridization between Jarila and other high ginning and wilt resistant cottons was carried out during the year under report and selected material is now being utilised for further testing under wilt affected and wilt free soil conditions. The cross [(Jarila × N.R. 5) Fl × New Million Dollar] Fl has yielded segregates with a much higher ginning percentage than Jarila and equal to it in yield and earliness. Back-crossing is being resorted to in order to emphasize desired characters in future segregates. The study of all material obtained with regard to wilt resistance is being carried on in

close co-operation with the Plant Pathologist to Government who is engaged under the Cotton Wilt Breeding Scheme, also financed by the Indian Central Cotton Committee, in the production of wilt immune cottons for Surat, Broach and Khandesh in co-operation with the Cotton Breeders in these tracts.

(15) (*c*) *Southern Division.*—Scientific work in cotton improvement in the Southern Division of the Province is centred at the Government Research Station, Dharwar, where experimental work on the Kumpta and Dharwar American cotton crops is in progress, particular attention being given to improvement in the yield and hardiness of the improved varieties now under general cultivation, viz., Jayawant and Gadag No. 1. Work on the evolution of wilt resistant strains of Jayawant cotton is also being carried on at this centre.

Selected strains in Kumpta cottons, notably, Early Jayawant and New Jayawant, were again tested in replicated experiments with Jayawant and local Kumpta cottons. New Jayawant gave significantly higher yields than the other improved types. Fresh hybridization work was undertaken with the object of combining wilt resistance and high ginning in Kumpta cottons and the study of crosses and back-crosses previously made was continued. In American cottons, segregates 4-4-1-1, 9-7-6-6 and 12-6-4-2 from the cross Gadag No. I × Co : II were tested both at Dharwar and Gadag and indicate that useful economic characters may be obtained from this material, which is superior in ginning percentage and yield to Gadag No. 1. The establishment of a small station at or near Gadag for further scientific work on American cottons in the Southern Division is essential to future progress in this direction as Dharwar is not a suitable centre for American cotton cultivation.

(16) (*d*) *Miscellaneous.*—The work being carried out under the Cotton Wilt Research Scheme by the Plant Pathologist to Government has been referred to above and such investigations are now an essential complement to pure plant-breeding for cotton improvement in practically every cotton-growing tract in the Province. The technique for testing cotton strains for wilt resistance has now been fully developed and important economic results are certain to result from the co-operation between the various Cotton Breeders and the Plant Pathologist in the production of wilt-resistant strains of cotton in the districts.

(17) At all Government Farms in the Province where cotton cultivation is carried on, agronomic experiments on the technique of cotton tillage, manuring and rotations were continued

in accordance with carefully considered experimental programmes. The progress made in such work is given in detail in the Appendices to this Report submitted by the Deputy Directors of Agriculture, Northern and Southern Divisions.

B. RICE.

(18) Scientific research work on the improvement of the rice crop in the Province is being carried on at the Government Research Stations at Karjat, for the rices of the Kolaba and Thana districts, at Mugad, for the rices of the Southern Maratha Country and at Kumpta and Ratnagiri for the Konkan rice crops. A scheme for the initiation of similar work on the Gujarat rices has recently been prepared and submitted to the Imperial Council of Agricultural Research for financial assistance.

(19) (*a*) *Karjat.*—The previous work of botanical selection in the Zinya, Bhadas, Kada, Jirbuti, Mahadi and early and mid-late Konkan varieties was carried a stage further during the year. In almost all these varieties, selections have now been made which appear superior to the local bulk material and these are being utilised for further trials. Work is also in progress on selection from scented rices, e.g., Kamod Chimansal, Raybhog, Ambemohor and other types, and replicated field trials with promising strains have been commenced. A considerable amount of hybridization work has also been carried out in order to obtain high-yielding varieties with good grain characters for extension in the Thana and Kolaba districts. These hybrids are mostly obtained from crosses between different improved strains of Kolumba rices and between strains of Zinya and Kolumba rices. Agronomic experiments on different techniques for rice transplanting were commenced.

(20) (*b*) *Mugad.*—At the Mugad Rice Breeding Station in Dharwar district, improved strains of Dodagya rice were again tested in replicated field experiments and the strains 5-1-1, 6-2-2 and 6-2-3 which have been consistently superior to other strains and the local Dodagya rices will be continued for similar work next season. The work of testing non-Bombay rices has been discontinued as no significantly superior types could be obtained to compete with the local varieties. Selected strains in Antersal rices and in local fine rices were also tested during the year and a few promising ones have been retained for further trials on a field scale in 1940–41. Hybridization work was confined to crosses to evolve early, mid-late and late rice varieties with suitable economic characters and a purple

colour of stem and leaf so as to facilitate rogueing out of wild rices from the rice fields, to obtain higher-yielding types of scented rices and to produce types suitable for high lands and scanty rainfall conditions. This work is only in its preliminary stages.

(21) (*c*) *Kumpta and Ratnagiri.*—At the Government Farm, Kumpta, field trials of improved rice varieties in comparison with local types were continued. In early, mid-late and late varieties, higher yielding strains suitable for extension in the Konkan tracts have now been obtained and will receive further testing in the districts. Yield trials of Muginbeldu and Upghat White Halga strains, selected for increased grain yield, have confirmed the results of similar work carried out in previous seasons. At the Government Farm, Ratnagiri, work is now confined to the maintenance of the purity of the seed of improved strains, which are higher yielding, both with regard to grain and straw, previously evolved at this Station, and to the multiplication of their seed for distribution in the districts.

C. WHEAT.

(22) During the year under report, the wheat-breeding work in force at the Cereal Breeding Station, Niphad, which is the main cereal improvement centre in the Province, was continued under the Crop Botanist to Government. The improved cross from Bansi wheat, viz. : B. G. 8·1, was tested again against other improved strains and the local Bansi and was also tried out in cultivators' fields in the districts. It maintained its high-yielding character but further field trials in other wheat-growing tracts are necessary before it can be released for general distribution. Other hybrid wheats obtained from the crosses Baxi 33×808 and Bansipalli 808×Polish F5 were tested for yield and the results justify further experimentation with certain segregates of promise. Pusa wheats were also tried in comparison with improved local types but without any superiority of the former being shown. Certain selected strains and segregates were multiplied for testing for reaction against black stem rust. The scientific work of wheat breeding in the Province requires early expansion in order to meet the requirements of other, main wheat-growing tracts. The scheme for testing the reactions of different black soil wheat varieties to wheat rusts has been sanctioned by the Imperial Council of Agricultural Research. Work under the Plant Pathologist to Government will shortly be started at Poona and Mahableshwar where glass house accommodation is under construction.

D. OTHER CEREALS.

(23) Scientific work on the botanical improvement of *bajri* was continued at the Cereal Breeding Station, Niphad, pending the establishment of a *bajri*-breeding centre in an area more suited for *bajri* cultivation. This work included yield trials of promising bulk selections and a study of hybrid strains evolved with the object of obtaining higher yielding types.

At the Mohol Jowar-breeding Station in the Southern Division, varietal trials of improved strains of Maldandi and Dagadi *jowar* varieties were continued. Three strains of these common local varieties appear to be higher-yielding than the local types but further work on these improved strains is necessary to confirm previous results over a number of seasons.

E. TOBACCO.

(24) The main centres of scientific work on the improvement of the tobacco crop in the Province are at Nadiad, for the tobacco crops of Gujarat, and at Nipani, for the improvement of the important tobacco crop grown in the Southern Maratha Country. The main lines of work at these stations are (*a*) selection and breeding of high-yielding and superior quality strains from local varieties (*b*) improvement of yield and quality by cultural, manurial and rotational methods, (*c*) multiplication of seed of improved types of tobacco and (*d*) research work on the selection, cultivation and curing of cigarette tobacco varieties.

(25) (*a*) *Nadiad.*—Comparative yield trials of the improved selections in the Keliu variety, viz., K 24, K 49, and the hybrid variety II-6-2 were continued. No significant differences in yield were obtained but the hybrid variety was found to be earliest in ripening. Both K 24 and K 49 have a stronger smoking quality which is an advantage in the local trade. Fresh work has been commenced with the Saijpur variety of tobacco grown in Borsad taluka. Certain varieties of cigarette tobacco, notably Harrison Special, Adcock, Gold Dollar, Bonanza and Cash have been found to be suitable for cultivation under Gujarat conditions and further work on these varieties is in progress. Experimental work on the technique of raising tobacco seedlings, the control of "damping off" of seedlings and flue curing of cigarette tobacco was continued with useful indicative results.

(26) (*b*) *Nipani.*—This station has only recently been opened and the thirty-six selections from the Surti, Baglani and Bhopli varieties, which were reported last year, were

studied during the year under report for their purity and agronomic characters. Of these, 10 selections have been retained as promising types. Thirty-seven fresh selections have been made from various samples of the local crops grown for further study during the year. Tobacco varieties were imported from Nadiad and Guntur and tested under Nipani conditions. None of these appear to be of much use in this area. Similarly, seeds of 11 varieties of cigarette tobacco were brought from different places and tested at the Station. The work is still in progress and a curing-barn is being constructed. Agronomic experiments were carried out on distance of planting and the effect of " topping ". The spacing of 30" × 30" was found significantly superior to any other under trial. The effect of " topping " was to reduce the yield. The site of this station will shortly be transferred to Soundalgi where a larger area of land is available and a curing-barn, etc., will be constructed.

F. OTHER CROPS.

(27) (*a*) *Linseed.*—During the second year of the extension period of the Linseed Breeding Scheme, financed by the Sir Sassoon David Trust Fund, replicated yield trials of the 18 best selected strains of 1937-38 were carried out. The superiority of certain Nasik, Deccan and Sholapur strains over the local varieties was indicated as a result of these trials. Hybridization work was continued and further selection of promising individual plants was again made. The important economic characters of improved strains were determined in the field and laboratories.

(28) (*b*) *Castor.*—Experimental work on the improvement of the castor crop in Gujarat was continued at Nadiad and single plant cultures from improved strains were under study. The seed of the improved variety S 20 was distributed in the districts through the local staff of the Rural Development Department.

(29) (*c*) *Other Oil-seeds.*—The Oil-seed Breeding Scheme financed by the Sir Sassoon David Trust Fund and carried out by the Economic Botanist to Government completed its second year in 1939-40. Work of botanical selection was continued in sesamum, niger and safflower, special attention being given to high yield and increased oil content. In sesamum, 25 selections have been made which combine these desirable economic characters with different degrees of time of maturity and their further study will be continued next season. In niger, 15 selections have been made which give promise of

desirable economic characters, especially increased oil content. Similar selection work has been done among safflower varieties. Yield trials were also carried out with 20 types and will be continued next season. Under the Crop Botanist to Government, scientific work for the botanical improvement of til and safflower was carried out at Niphad, and trials of improved selections were made during the year under report. Some of these gave most promising results as regards increased yield. These trials will be continued.

(30) (*d*) *Gram.*—The testing of improved strains of gram for wilt resistance was continued at the Government Farm, Dharwar, where the wilt-resistant strain No. 18–12 again indicated its superiority over the local variety in wilt affected areas. In addition, different varieties of gram from other parts of India and Burma were tested and wilt resistant types maintained for further study. Under the Crop Botanist to Government, scientific work on the improvement of the gram crop at Niphad included yield trials of selected strains of which strain No. 816 was significantly superior to all others under test. The seed of this improved strain will now be multiplied for distribution in the districts. Fresh selections in gram varieties from Khandesh and Nasik were made.

(31) (*e*) *Sugarcane.*—The main scientific work on sugarcane in the Province is carried out at Padegaon under the Sugarcane Research Scheme, Bombay-Deccan. At this centre, botanical work on the cane crop is not done but new varieties of improved cane obtained from other parts of India, notably, Coimbatore, are rigidly tested to ascertain their respective suitability for different types of cane cultivation, e.g., plant, adsali and ratoon, under Deccan conditions. Similar work is in progress at the Government Farm, Kopergaon, where, in addition, agronomic experiments in cane cultivation, irrigation and manuring are also in progress. This Farm is being converted into a sub-station of the main Research Station at Padegaon for work on sugarcane in future.

(32) (*f*) *Groundnut.*—The groundnut crop is of great importance in Khandesh and in other parts of the Province where its cultivation has increased considerably within recent years. Trials of improved varieties of this crop, including the Spanish Peanut and Pondicherry types, were carried out at the Government Farm, Dharwar, and at the Government Farm, Kopergaon. In the Northern Division, similar work is in progress at the Dohad Agricultural Station in co-operation with the Oilseeds Specialist, Coimbatore.

G. GRAZING AND FODDER CROPS.

(33) The work under the large scale rotational grazing experiment, supervised by the Economic Botanist to Government at Mangdara *Kuran*, Poona, was continued but results were vitiated by the extremely low rainfall received over the area of experiment and the consequent extremely poor growth of grasses. A study is being made of exotic fodder grasses and legumes obtained from other parts of India and abroad. Trials of Dry Napier Grass at different Government Farms in the Province have shown that this grass would be a very useful and important addition to the fodder crops of the Province.

(34) *Provincial and District Fodder and Grazing Committees.*—The establishment of the Provincial Fodder and Grazing Committee and of District Fodder and Grazing Committees has given considerable impetus to work in connection with the improvement of grass lands and the development of fodder crop cultivation. There are now District Fodder and Grazing Committees in all but five districts in the Province and many subjects dealing with the improvement of grazing and fodder crop cultivation have been dealt with by these bodies. The Provincial Fodder and Grazing Committee not only co-ordinates the work of the District Committees but also initiates schemes for fodder and grass-land improvement and, during the year under report, several such schemes were approved by this body and forwarded to the Imperial Council of Agricultural Research. The Committee also considered the question of a grass-land and fodder survey in the Province, the revised Forest Grazing Rules, improvement of drinking water facilities in forest grazing areas and other important subjects relating to the development of fodder and grass-land resources in the Province.

SECTION C.

Livestock Research Work.

(35) (*a*) *Cattle.*—Scientific research work on the improvement of the cattle-breeds of the Province is carried out by the Livestock Expert to Government at Government Cattle-breeding Farms. At the Northcote Cattle Farm, Chharodi, Gujarat, work on the Kankrej breed of cattle was continued on the herd of 450 animals maintained there. The breeding policy aims at the development within the herd of the important characteristics of (1) early maturity, (2) regularity of calving and (3) adherence to type. Study of

the effect of different breeding bulls on the transmission of "early maturity" to their female off-spring was continued and the progressive improvement in this characteristic by the selective use of breeding bulls since 1917 is most noticeable. With regard to improvement in milk yield, over 44 per cent. of the cows yielded over 2,000 lbs. milk per lactation, the highest yield being 5,808 lbs. milk from a cow in her second lactation period. The Northcote Cattle Farm, Chharodi, and the herd established there have been transferred by Government to the Institute of Agriculture, Animal Husbandry and Dairying, Anand, Gujarat, from 1st April 1940.

At the Bankapur Cattle-breeding Farm, Dharwar district, the herd of Amrit Mahal cattle maintained there have now reached a high standard with regard to early maturity, regularity of breeding and type adherence as the result of the breeding policy followed in the past. This policy is being continued at the Tegur Cattle-breeding Farm, Dharwar district, a scheme of re-organization has been commenced with the main object of utilising this station for scientific work on the improvement of the two valuable draught breeds, the Nimari and the Dangi. The graded herd of Amrit Mahal cattle, formerly maintained at Tegur for the production of breeding bulls and bullocks, has been dispersed at public auction and the Farm is now being prepared for the reception of the new stock and for scientific work on the two draught breeds mentioned above.

Work on the scientific improvement of the valuable Gir breed of dairy cattle was continued by the authorities of the Bombay Gowrakshak Mandali in co-operation with the Live-stock Expert to Government. Similar work is being done with the same breed at the Nathu Lalji Charity Trust Fund Gowshala, Mulund. Both these private institutions gained valuable awards for their Gir cattle at the All-India Cattle Show, Delhi.

The Livestock Expert to Government is also associated with the work done by the Taluka Development Associations of Jalgaon and Jamner in the East Khandesh district at their cattle farms at Pimple and Gangapur, respectively, where the scientific breeding of the Nimar breed of cattle is being undertaken.

(36) (*b*) *Sheep—Sheep Breeding Research Scheme, Bombay-Deccan, Bhamburda, Poona.*—This scheme which is financed partly by the Imperial Council of Agricultural Research and partly by the Provincial Government aims at the improvement of the Deccani breed of sheep (1) by selection and (2) by crossing with the Merino breed of sheep from South Africa.

The year under report, which was the third year of the scheme, showed considerable progress towards these objects. Much progress was made in the study of individual fleeces and the grading of the flock on the result of such study, upon which results future breeding policy will be based. A larger field for selection is necessary and measures to this end have been submitted to the Imperial Council of Agricultural Research for approval. The work of crossing the Deccan and Merino breeds was continued and a very considerable improvement in quantity and quality of wool is evident in the early cross-breeds obtained. The need for a small Wool Analysis Laboratory under the Scheme is urgent. Further problems investigated dealt with the time of lambing, prevention and control of diseases and pests of sheep, shearing and grazing technique. Most important and economically valuable results have been obtained from preliminary work on wool utilization with the object of enabling the local shepherds to obtain higher prices through the grading and selection of wool, spinning and dyeing.

(37) (*c*) *Poultry—Bombay Poultry Research Scheme, Kirkee.*—This Scheme was started in 1936 and is carried out at the Government Poultry Research Station, Kirkee, Poona, and at sub-stations at Vadala, Ahmednagar district, and at Ankleshwar, Broach and Panch Mahals district. Very useful results in increased stamina and egg-laying capacity have been obtained from crosses of the White Leghorn × Rhode Island Red and other crosses of indigenous breeds with imported breeds. Additional work comprised feeding experiments, incubation trials and experiments on the production of cheap poultry houses for village use. At the Government Central Poultry Farm, Kirkee, experimental work on laying tests, artificial incubation and feeding was carried a stage further with very satisfactory results. The economics of poultry farming is receiving close attention at this centre which is also being largely utilised for the training of villagers and students in poultry management. 47 students completed the full poultry training course during the year. Interesting work was done on the breeding and rearing of turkeys. Auxiliary Government Poultry Farms have recently been established at Dharwar and Dhulia where similar work to that carried on at the Central Poultry Farm, Kirkee, is in progress.

(38) (*d*) *Goats.*—As numerous inquiries had been received from all parts of the Province regarding the use of goats for milk production, a small experiment with the Kamori breed of goats

from Sind was commenced at the Government Central Poultry Farm, Kirkee. This work has just commenced and the milk-yielding capacity of the stock obtained is being investigated.

(39) (*e*) *Bees.*—The Bee Expert continued his work in connection with a survey of the distribution of different types of bees in the Province and carried out experiments on the domestication of Aphis dorsata and on artificial feeding of bees. A special course of training in apiculture was given to 79 students attending the Horticultural Training Class at the Government Fruit Experimental Station, Ganeshkhind.

SECTION D.

Miscellaneous Research Work.

(1) *Horticultural Research.*

(40) (*a*) *Cold Storage Research Scheme, Ganeshkhind.*—The year under report was the sixth year of the Cold Storage Research Scheme for scientific investigations into the technique and economics of the cold storage of Indian fruits and vegetables. This Scheme is financed by the Imperial Council of Agricultural Research and has been extended until April 1942.

During 1939-40, cold storage experiments were conducted upon oranges from Nagpur, bananas from Bassein, pears from Kashmir and on mangoes, figs, papayas, limes and tomatoes. Nagpur oranges were found to store well at a temperature of 40°F. but would require to be distributed by means of refrigerated railway transport after this period otherwise the juice gives a slightly fermented odour. Pears from Kashmir kept well for four months at 32°F. Ripe figs were stored in a sound condition for about a month at 32°F. and 35°F. while limes remained sound at a temperature of 52°F. for two months if stored in a closed tin. Green tomatoes ripened at 52°F. and developed a good colour within a month.

Experimental work upon the gas storage of different fruits has now been commenced.

(41) (*b*) *Government Fruit Experimental Station, Ganeshkhind.*—Experimental work at the Government Fruit Experimental Station, Ganeshkhind, which is the main fruit research station in the Province, was mainly concentrated upon investigations into the manurial requirements of bananas, grapes, mangoes and Mosambi oranges and on

research work in the technique of irrigation of citrus orchards. Most of these experiments are of a long range type and will require to be conducted over a number of years before results will be obtained. By botanical selection, improved high-yielding varieties of guavas and pomegranates have been obtained. Trials are also being given to new and imported fruit and vegetable crops. The total receipts from sale of produce at the station amounted to Rs. 13,257 as against cultivation costs of Rs. 11,803. At the Modibag Gardens, Agricultural College, experimental work on the production of healthy, and strong jamburi seedlings for budding with superior varieties of citrus are in progress. Steps have been taken to place these Gardens on a commercial footing and the receipts during the year exceeded the contingent expenditure by Rs. 424.

(2) *Research Work in Agricultural Engineering.*

(42) Under the Agricultural Engineer to Government, research work on the improvement of existing agricultural implements and on the devising of new agricultural implements for specific farm operations was continued. Further trials were carried out at Jalgaon with the improved seed drill mentioned in last year's report and the results obtained are encouraging as the increase in yield obtained from crops sown by the improved drill was 10 per cent. higher than those obtained by use of the local drill. Additional experiments under different soil conditions are, however, necessary. The improved winnowing fan has now been well tested out in the districts and a number of these implements have been purchased by cultivators. As a result of experience gained in the working of the fans under district conditions, certain minor modifications in design were found desirable and these alterations have been worked out in the Agricultural Engineer's workshop and will be incorporated in future models.

Work is still in progress on the best and cheapest method of converting original cart-wheels to the ball-bearing type and experimental results in this direction are being tested out under normal working conditions in the districts.

In co-operation with the Livestock Expert to Government, the Agricultural Engineer undertook the design and manufacture of an experimental plant for the artificial drying of grass. This work has been done to meet the requirements of a scheme for research work into artificial grass drying which has been submitted to the Imperial Council of Agricultural Research and which received the approval of that body.

Preliminary trials with the experimental plant have been carried out and a large unit is now under construction for further experimental work, particularly in connection with the economics of the process and the technique required to obtain a final product of dried grass with as low a moisture content as possible.

(3) *Research Work in Crop Protection.*

(43) (*a*) *Against plant diseases.*—During the year under report, considerable progress was made in research work on the prevention and control of plant diseases under the Plant Pathologist to Government. Full details of such work are given in the Annual Report of that officer (Appendix F) and only brief notes on the progress made in the major items of work are given hereunder :—

(1) *Fusarium wilt of sann hemp.*—Experimental work to determine the relative efficiency of *Apis* and *Megachile* bees in pollination of sann hemp flowers was continued. No significant difference was noticed. The testing of crosses between the wilt-immune strain D-IX and homozygous susceptible individuals in wilt-infected soil temperature tanks was continued and back-crosses were made. Fresh isolates of the wilt organism have been obtained and are being tested for their virulence. The multiplication of the seed of the wilt-immune strain was continued at the Dharwar Farm.

(2) *Wilt in Lathyrus sativus.*—Selections have been made in varieties of *Lathyrus sativus* obtained from Poona and Indore after these varieties were tested in wilt-sick soil. Further experiments were carried out to determine the relationship between soil temperature and the development of wilt and the results obtained confirm previous year's experiments. The causative fungus has been fully described.

(3) *Koleroga of betel-nut.*—Experimental work at Sirsi on the method of carry-over of the causative organism of *koleroga* confirmed the previous year's results. Throughout the dry season, the fungus (*Phytophthora arecæ*) could readily be isolated from the dead or dying tops of areca nut palms and soil at the base of trees known to have been severely attacked in the previous season, have been shown to yield the organism readily in pure culture. The common belief of the gardeners that the spread of the disease radiates from

definite centres in the gardens has been proved to have a scientific basis as trees have been found to carry latent infection without showing signs of disease in the dry season. A method has now been devised whereby such trees, barbouring latent infection in their tops, can be distinguished. With the removal of such sources of infection before the monsoon season, supplemented by the spraying of only such trees as harbour latent infection in their tops early in the monsoon season, it is possible that a cheap and effective method of control can be achieved. This possibility is now being tested on a large scale in the garden tract of Kanara District. Spraying trials to test the relative efficiency of different adhesives in spraying mixtures were carried out.

(4) *Cotton Wilt Breeding Schemes.*—Under the Cotton Wilt Breeding Schemes, Gujarat and Khandesh, the Plant Pathologist to Government has made considerable progress in the production of wilt immune cotton strains for Broach and Panch Mahals district in co-operation with the Cotton Breeder, Broach. The two cultures B. D. 8-B4 and B. D. 8-B7 and some of the segregates of the Broach back-cross, are most promising in this respect. There appear to be equally good prospects of obtaining homozygosity for 100 per cent. wilt resistance in Surat and Khandesh cotton strains and wilt-resistant segregates are being used in further hybridization work for these tracts. The study of wilt inheritance in cottons was continued.

(5) "*Damping off*" *in tobacco seed-beds.*—The use of different fungicides for the disinfection of soil in tobacco seed-beds as a method of controlling "damping off" of seedlings was investigated further and effective results were obtained by the applicaton of the proprietary compounds "Bouisol" and "Perenoz" at small cost to the growers.

(6) *Miscellaneous.*—Further scientific work was carried out on numerous other plant diseases including "soft rot" of ginger, fig rust, Panama disease of bananas, black spot of mangoes, rust on chrysanthemum and others. The results of the investigations into these diseases and fungi by the Plant Pathological Section are, in most cases, very promising and indicate the possibility of devising simple and cheap methods of prevention or control. Many of the treatments under trial are now at a stage when they can be tested out in the districts.

(7) *Plant Virus Disease Research Scheme.*—The work under this Scheme, which is financed by the Imperial Council of

Agricultural Research, is still in its preliminary stages and a collection of virus diseases of numerous plants of economic importance has been made. Special experiments upon the transmission of yellow vein mosaic disease of *bhendi* (*Hibiscus esculentus*) were carried out and the relationship between the mineral nutrition of the plant to its susceptibility to this virus disease was investigated.

Under the direction of the Economic Botanist to Government, the scheme for research work into the attack of "*striga*" on the *jowar* crop was continued for its second year. Some strains of "Bilichigan" *jowar* have been obtained which show 100 per cent. resistance to *striga lutea* and, in other varieties, highly resistant strains have been evolved. The laboratory studies to determine the optimum conditions of temperature and humidity for the maximum attack of the parasite have been completed.

The Economic Botanist continued the work of selection of tobacco strains resistant to the attack of *orobanche* but the results obtained from this line of work have not been satisfactory. It is now proposed to collect material from other tobacco growing tracts in India and abroad in an endeavour to find resistant material which could be used in hybridization work with local tobacco varieties.

(44) (*b*) *Against insect pests.*—The main subjects of entomological research carried out by the professor of Entomology during the year under report are noted in brief below :—

(1) *Experimental work on sulphur dusting against mango hoppers.*—Research work was continued in private orchards in Gujarat and in the suburbs of Bombay to determine the optimum number of dustings required and the optimum time of starting such dustings and the period between each dusting.

(2) *Fruit flies.*—The establishment of a collection of fruit flies attacking common fruits in the Province was continued. Experimental work on the control of these insect pests by the use of poison baits was carried out but the results obtained were inconclusive.

(3) *Grape vine beetle.*—A scheme for the investigation of the life history of this pest and for the evolution of effective and economic methods of prevention and control is being

financed by the Sir Sassoon David Trust Fund, Bombay. Preliminary work was conducted in grapevine orchards at Nasik during the year under report and the life history has now been almost completely worked out.

(4) *Miscellaneous.*—Experimental work was carried out on other insect pests of minor importance including the fig hopper and the betelvine bug and methods of control of these insect pests are now available and under final test. Different insecticides against aphis and thrips were also tested.

(4) *Agricultural Economics and Marketing.*

(45) The economic enquiry into farm family budgets of cultivators in the Chharotar tract of Gujarat was completed during the year under report and the results prepared for publication departmentally. In addition, research was conducted into the marketing of vegetables in the vicinity of Poona City and the Professor of Agricultural Economics supervised survey work on the marketing of sugar, *gul*, sheep and goats, fish, lac, mangoes, apples and pineapples prior to this work being handed over to the Rural Development Department. The developmental side of marketing was extended and preliminary work was done in fixing grade specifications for rice, groundnut and mango products. The grading of hides, eggs, *ghee*, *mosambi* and mangoes was continued at experimental grading stations.

SECTION E.

Further Research Schemes.

(46) (*a*) *Imperial Council of Agricultural Research.*—During the year under report, only one new research scheme, viz., "Scheme for the investigation of the water requirements of crops other than sugarcane", was sanctioned by the Imperial Council of Agricultural Research.

The under-noted schemes started on an extension period, sanctioned by the Council, during the year :—

(1) Sugarcane Research Scheme, Bombay-Deccan, Padegaon.

(2) Cold Storage (Gas Storage) Research Scheme, Ganeshkhind.

(3) Dry Farming Research Scheme, Bombay, Sholapur.

The four schemes mentioned below have already been sanctioned by the Imperial Council of Agricultural Research and will be commenced next year :—

(1) Scheme for research work on the cytology of the papaya.

(2) Scheme for testing of reactions of wheat to black stem rust.

(3) Scheme for preparation of monograph on dry farming research in India.

(4) Bombay Wool Analysis Scheme (under the University of Bombay).

A scheme for research work in goat breeding in the Province has been sanctioned by the Council but is still awaiting the allotment of finance.

During the year under report, thirteen new research schemes were submitted to the Imperial Council of Agricultural Research and are still under consideration by that body.

(47) (*b*) *Sugar Excise Fund.*—The under-noted schemes were commenced during the year under report finance being provided by the Government of India from the Sugar Excise Fund :—

(1) Scheme for the establishment of five sub-stations for research work under the Sugarcane Research Scheme, Bombay-Deccan, Padegaon.

(2) Scheme for the extension of the genetical method of soil-survey in the Deccan Canal tracts.

(48) (*c*) *Indian Central Cotton Committee.*—A scheme for scientific botanical research work on the improvement of the cotton crop in the Kaira district, North Gujarat, was sanctioned by the Indian Central Cotton Committee during the year under report but work under this scheme has not yet been started.

(49) (*d*) *Sir Sassoon David Trust Fund.*—Two new research schemes, viz., " Scheme for the study of availability of phosphates in typical soils of Western India " and " Scheme for investigation into the Grape-vine Beetle " were sanctioned by the Trustees of the Sir Sassoon David Trust Fund, Bombay, during the year under report.

CHAPTER III.

LIVESTOCK WORK.

(50) (*a*) *Introduction.*—The work of the Livestock Section of the Agricultural Department was intensified considerably during the year under report and this expansion reflects the increased interest taken by the public in all aspects of livestock improvement and development in the Province. The closer co-ordination which has been achieved between the improvement of livestock and the development of better grazing facilities and fodder production, through the efforts of the Provincial Fodder and Grazing Committee, is a significant and welcome feature of the year's work. Another important step in the direction of cattle improvement was the appointment of an Expert Cattle Committee to frame proposals for the development of milch cattle and the expansion of the dairy industry in suitable tracts of the Province. The recommendations of this Committee are now under the consideration of Government.

(51) (*b*) *Premium Bulls.*—During the year under report, 102 additional breeding bulls of different breeds were supplied to selected agents in villages under the "Premium Bull" system. It is most interesting to note that 80 of these bulls were the issue of Premium Bulls previously distributed by the Livestock Section of the Agricultural Department, thus indicating the value of such work in the progressive improvement of village cattle. 336 Premium Bulls were situated throughout the Province in July, 1940, as compared with 278 in July 1939. In many tracts of the Province, the influence of these selected breeding bulls on the raising of the standard of village cattle is now most noticeable. Under a similar "Premium Cow" scheme, 65 selected breeding cows have also been issued in suitable villages, largely in co-operation with Village Improvement Committees.

(52) (*c*) *His Excellency the Viceroy's Gift Bull Scheme.*—In the Province, the total contributions received towards His Excellency the Viceroy's Gift Bull Scheme now amount to Rs. 88,378 of which Rs. 54,021 have already been expended in the purchase and maintenance of selected breeding bulls for use in villages. Since the commencement of work under the scheme, 296 bulls have been located in villages. Of these, 25 have died and 83 have completed the service period, leaving 188 still at stand in different villages. More progress in the

fulfilment of the important objects of this Scheme may be anticipated in the near future as the result of the centralization of the work of livestock improvement in the districts under the Livestock Expert to Government.

(53) (*d*) *Scheme for Buffalo Breeding and Improvement.*—This scheme, which was commenced two years ago, provides for the issue of male buffalo stock of known highmilking strains from the Agricultural College Dairy, Poona, to selected buffalo breeders in Kaira district, Gujarat. The young male stock thus distributed are reared by the agents and utilised for issue as " Premium Bulls " when fit for breeding purposes. Seven Surti buffalo male calves were issued under the Scheme this year and there are now 29 buffalo breeding bulls situated under the " Premium " and " Gift " Bull Schemes at work in various villages throughout the Province.

(54) (*e*) *Application of the Livestock Improvement Act of* 1933.—The Bombay Livestock Improvement Act of 1933, which provides enabling legislation for the compulsory castration of " scrub " male cattle stock in villages on the instance of local bodies, has now been applied to 77 villages in the Province. During the year under report, 1,068 castrations of " scrub " bulls were carried out by Assistant Veterinary Surgeons in 35 villages. The effect of the Act in village cattle improvement has been most marked in the areas where it has been applied and, with the co-operation of the villagers, it has worked very satisfactorily towards raising the standard of village herds of cattle.

(55) (*f*) *Co-operation with Gowshalas and Panjrapoles in the improvement of cattle.*—The Livestock Expert to Government intensified his efforts to secure the co-operation of gowshalas and Panjrapoles throughout the Province in the work of cattle improvement and the bulk of such institutions in the Province were visited for this purpose. A detailed report on the conditions upon which such co-operation can be secured in the case of individual institutions has been submitted to Government.

(56) (*g*) *Cattle Shows, Rallies and Demonstrations.*—The Province was again well represented at the All-India Cattle Show, held at Delhi in February, 1940, when 50 animals, typical of the main breeds of the Province, were exhibited. These exhibits obtained numerous awards and prizes, including the Hyderabad Challenge Cup for the best bull in the Show

which went to a Kankrej bull from the Government Cattle Farm, Chharodi, Gujarat, and a Cup for the best all-round cow bred and reared by a private institute which was awarded to a Gir cow shown by the Mulund Gowshala.

District Cattle Shows and Rallies continued to form an important part of departmental propaganda in cattle improvement and, during the year under report, 34 small district shows and two cattle rallies were held by the Livestock Section. The most important of these district shows was held at Khandala, in the Alibag taluka of the Kolaba district, in January 1940 when His Excellency the Viceroy was present.

(57) (*h*) *Advisory and Propaganda work in the districts.*—During the year under report, all district advisory and propaganda work in connection with livestock improvement was centralized under the Livestock Expert to Government. This step has proved to be most effective in the intensification of such work in the districts and in the adoption of co-ordinated measures for livestock improvement throughout the Province as a whole. Progress has been made in framing measures for checking the adulteration of *ghee*, for the improvement of the village butter and *ghee* industry in Khandesh and the Southern Maratha country and in the preparation and initiation of projects for livestock improvement in co-operation with Village Improvement Committees and District Rural Development Boards. The Livestock Expert to Government has taken effective steps to acquaint non-official workers with the work of the Department in cattle and livestock improvement and to secure their co-operation in the working of schemes with that object in view.

(58) (*i*) *Formation of Milk Recording Societies.*—The work undertaken under this scheme aims at commencing a system of village milk recording for certain milch breeds of Indian cattle and is being carried out in co-operation with the Imperial Council of Agricultural Research. Nine villages in the Sanand taluka of the Ahmedabad district have been taken up for the purposes of the scheme, with the co-operation of Kankrej cattle breeders in that area. The actual work of milk recording commenced with 99 cows in September, 1939, and from that month until March, 1940, records of 157 cows were maintained with reference to quantity and quality of milk by fortnightly tests. The work is still in progress.

(59) (*j*) *Definition of breed characteristics.*—On the initiative of the Imperial Council of Agricultural Research, steps are being taken to lay down systematic definitions of the breed characteristics of the main cattle breeds in India. In the Province, this work has been commenced on the Khillari breed of cattle and the Surti breed of buffaloes under committees of local cattle-breeders and other interested parties, both official and non-official, presided over by the Livestock Expert to Government. The reports of these committees, together with photos and measurements of typical specimens of the breeds under consideration, have been forwarded to the Imperial Council of Agricultural Research during the year.

(60) (*k*) *Poultry improvement in villages.*—During the year, two schemes for the improvement of poultry in villages were in force. The first of these schemes aims at the improvement of village poultry by the distribution of selected cockerels for breeding purposes in selected villages and under the care of approved cultivators. 490 White Leghorn, Rhode Island Red and Black Minorcas cockerels were put out in villages during the year and this work has been found most effective in improving the standard of quality and egg-laying capacity of village fowls. Graded pullets, resulting from similar work in the past, have been found to show an increase of 40 per cent. in egg-laying capacity and to produce larger eggs than their dams under village conditions. The full benefit of this scheme, however, cannot be realized until the more systematic mark ting of graded eggs produced in villages can be organised on a wider basis and more effective measures taken to control and prevent the great mortality, resulting from poultry diseases in the districts.

The second scheme aims at encouraging sciertific poultry keeping by villagers through the grant of premia to intelligent cultivators for either the construction of up-to-date poultry houses or the purchase of fowls or egg settings of improved breeds. 14 such premia were granted during the year under report. District Poultry Centres, established mainly under the auspices of Village Improvement Committees, have been started in several districts and are giving useful co-operation and assistance to the Agricultural Department in village poultry improvement.

(61) (*l*) *Egg Marketing Scheme, Belgaum.*—This scheme, which is financed by grants from the Sir Sassoon David Trust Fund, continued its work for the scientific grading and marketing of eggs in the Belgaum district during the year. 81,690 eggs were dealt with and the bulk were marketed under the "Agmark" grades. Some difficulty is still being experienced in obtaining an adequate price for the higher grades of eggs which is essential to the successful working of the scheme and the extension of the work being undertaken over wider areas. A Central Egg Sale Society, organised on co-operative lines in Bombay, would be a great stimulus to the formation of egg marketing societies in the districts and would enable adequate prices to be obtained for the higher grades of eggs.

CHAPTER IV.

Agricultural Service and Propaganda.

(62) (*a*) *Introduction.*—As stated in the last year's report, the work of district demonstration and propaganda towards the extension of improved agriculture in the villages, including the organization of the supply to cultivators of improved seeds and implements has been removed from the Agricultural Department and entrusted to a newly formed Rural Development Department under the Registrar of Co-operative Societies and Director of Rural Development. In consequence of this radical change in policy, the district staff of the Agricultural Department, formerly engaged on district demonstration and propaganda work, seed and implement demonstrations, etc., was transferred to the Rural Development Department. Accordingly, the direct association of the officers of the Agricultural Department with agricultural propaganda and extension work in the districts has given place to indirect contact with such work through the Provincial Board of Rural Development and corresponding District Boards which have been organised in all districts of the Province.

(*b*) Seed Supply.

(63) In accordance with the change in policy mentioned above, the important work of the organization of the seed supply of improved varieties of crops now rests with the newly formed Rural Development Department, which is also responsible for the direction and supervision of seed multiplication and extension in the districts. The production of nuclei of the seed of improved varieties of crops is still carried out on the Government Farms and Research Stations by the expert technical officers of the Agricultural Department and pure seed of many varieties of improved crops is supplied to the distributive agencies of the Rural Development Department for further multiplication and extension in the districts.

(64) (1) *Cotton.*—The schemes for the distribution and extension of the seed of improved varieties of cotton in the Surat, Broach, Khandesh, Deccan Canals and Southern Maratha tracts were continued during the year under report by the Rural Development Department. The work of the Agricultural Department was confined to the production of nuclei quantities of the pure seed of the improved cotton varieties concerned which were then handed over to the Rural Development Department for further multiplication under registered seed-growers and co-operative organizations for seed supply to

cultivators. In the Northern Division, 21,075 lbs. of pure seed of 1027 A.L.F. cotton were produced and handed over to the Cotton Superintendent for further multiplication in the Surat tract. 13,520 lbs. of pure Jarila cotton seed was produced in Khandesh and similarly disposed of to the Cotton Superintendent, Jalgaon. The officers of the Rural Development Department in the Northern Division were supplied with smaller quantities of pure seed of other varieties of improved cottons required for district distribution and multiplication under organised cotton extension schemes, viz., the improved cotton varieties, B.D. 8 for the Broach and Panch Mahals district and Banilla cotton for the Deccan Canal tracts. In the Southern Division, the pure selfed seed of the improved cotton varieties, Jayawant and Gadag No. 1, was supplied from the Dharwar Farm to the seed multiplication agencies controlled by the Rural Development Department in the areas suitable for the extension of these varieties.

(65) (2) *Rice.*—Considerable quantities of the seed of improved rice varieties were produced at the rice-breeding stations in the Southern Division, i.e., Mugad, Kumpta and Ratnagiri and issued for further multiplication and distribution in the appropriate rice-growing tracts. The Rural Development Department purchased 9,710 lbs. of the seed of improved rice varieties produced at the Rice Breeding Station, Karjat, for distribution to registered seed-growers in the Thana and Kolaba districts.

(66) (3) *Other crops.*—The standard types of improved wheats grown at the Cereal Breeding Station, Niphad, viz., Bansipalli 808, Bansi 168 and Bansi 224, were multiplied for seed production and the pure seed produced distributed for extension in the districts. In the Southern Division, a large number of setts of improved sugarcane varieties, notably, Co. 419 and other Coimbatore types, were supplied to cane-growers and the distribution of the seed of other improved varieties of crops and of fruit tree seedlings was continued and increased. Similar work was done in the Northern Division where the seed of Pusa 4 wheat, and the improved varieties of local wheat, viz., No. 224 and No. 168, was produced in bulk on the Government Farms and issued for further multiplication in the districts. Smaller quantities of seed of other improved varieties of crops, e.g., tobacco, castor, etc., were supplied to Rural Development Inspectors for trial and demonstration on cultivators' fields.

(c) Crop Protection.

(67) (1) *Against wild animals.*—The organization and direction of the work of crop protection against wild animals, which was formerly carried out by a special shikar staff under the Agricultural Department, has now been transferred to the Rural Development Department under the re-organization scheme.

(68) (2) *Against plant diseases and insect pests.*—As in previous years, the Plant Pathologist to Government and the Professor of Entomology dealt with a large number of enquiries from the public on a wide range of subjects relating to plant diseases and insect pests on crops. Special demonstrations on the control of mango hoppers and mildew by spraying were carried out in the Southern Division and in the Bombay Suburban District. In the Deccan Canal tract, a scheme for the prevention and control of the grass-hopper pest on sugarcane was conducted by the Divisional Superintendent of Agriculture. The results of the different control measures tested and demonstrated to the cane-growers were most satisfactory and it is clear that this serious pest could be rendered of little importance if the cane-growers organise to carry out systematically the recommendations of the Agricultural Department for its prevention and control. The Plant Pathologist and the Professor of Entomology and their staffs co-operated with the district staff of the Rural Development Department in many areas in demonstrating to cultivators effective and economic measures against plant diseases and insect pests on agricultural and orchard crops.

(69) (d) *Propaganda and publicity.*—The important duties of extending the results of successful research work into general agricultural practice and of inducing the cultivators to adopt improved methods and materials of agriculture were entrusted to the district staff of the Rural Development Department during the year under report. The results obtained in this work will, therefore, be found in the Report of that Department. Technical officers of the Agricultural Department, however, co-operated on many occasions with the staff of the Rural Development Department in demonstration and propaganda meetings in the villages and acted as expert advisers in the preparation and execution of propaganda schemes for the extension of improved agriculture in the districts. The Deputy Directors of Agriculture and the senior members of their staffs were present at many meetings of the District Rural Development Boards and District Fodder and Grazing Committees and

also attending numerous gatherings of cultivators for discussion of agricultural problems and difficulties. All schemes for rural development pertaining to agriculture and animal husbandry framed by the District Rural Development Boards or the Village Uplift Committees are now submitted to the Agricultural Department for technical advice and approval.

(70) (*e*) *Agricultural marketing.*—The work in the Province in connection with the all-India agricultural produce marketing investigation has now been transferred from the Agricultural Department to the Rural Development Department consequent upon the transfer of the Chief Marketing Officer and his staff to the latter Department. Similarly, the Rural Development Department is now responsible for the organization and supervision of regular cotton markets in the Province.

(71) (*f*) *Agricultural engineering.*—The Agricultural Engineer to Government dealt with 312 applications from the public for advice and assistance in matters connected with agricultural engineering. Of these enquiries and applications, 58 were connected with pumping, 83 with boring, 45 with hire of plants, 29 with repair of plants and the remainder with miscellaneous subjects. 35 estimates for machinery and works were prepared and supplied. The number of power plants erected was 22 and repairs were carried out to 58 installations. 38 sites were surveyed and 170 power plants were inspected by the Agricultural Engineer and the three territorial Mechanical Assistants on his staff. A considerable amount of special construction work was carried out as a result of recent expansion in the research activities of the Agricultural Department. This special work included the erection of glass houses, plant houses, offices, etc., at Poona and Mahableshwar, the construction of poultry houses and runs at the newly-established Government Poultry Farm at Dharwar and Dhulia and numerous minor works on the Government Farms and Research Stations. During the year under report, seven boring machines were supplied on hire to the public, realizing a total hire receipt of Rs. 7,193. Eleven pumps were also issued on hire, the receipts on this account amounting to Rs. 367. The proceeds of the sale of boring machines, spares and tools to the public amounted to Rs. 4,477.

(72) (*g*) *Poona Agricultural College—Services rendered to the public by Heads of Sections.*—The demand for advice and assistance in agricultural problems, which has increased considerably in recent years was fully met by the Heads of Sections at the Agricultural College whose expert knowledge of different

aspects of scientific agriculture is readily available to all sections of the public. The number of samples of soils, waters, manures, foods and feeding stuffs, etc., submitted to the Agricultural Chemist for analysis greatly exceeded those dealt with in previous years and totalled 1 290 samples received from private individuals and officers of Government Departments. The Economic Botanist to Government, the Plant Pathologist to Government and the Professor of Entomology received a considerable number of enquiries from the public dealing with botanical, mycological and entomological problems of agriculture. All such enquiries were dealt with promptly and, when necessary, members of the expert staff at the College were deputed to visit enquirers and give advice and assistance in person. Special demonstrations on the control of mango hoppers and mildew were carried out by the staff of the Plant Pathological and Entomological Sections in orchards in the districts. The Bee Expert replied to over one hundred enquiries regarding apicultural matters and assisted private individuals and organizations in establishing bee colonies at numerous centres. The Professor of Agriculture received over 700 enquiries from the public on such diverse subjects as crops, manures, implements, seeds, milk and milk products, cattle feeding, etc., all of which were attended to promptly. Many of the expert officers at the Agricultural College assisted in the work of various sub-committees of the National Planning Committee.

CHAPTER V.

AGRICULTURAL EDUCATION.

(73) *The College of Agriculture, Poona.*—The year under report was the 32nd year since the establishment of the College of Agriculture at Poona and this institution continues to be the centre of agricultural education and scientific research in agriculture in the Province. The expert staff of the College are fully engaged in both these aspects of work and, in addition, they are being increasingly utilised by the public for advice and assistance in agricultural development and propaganda. The number of students attending the College during the year 1939-40 was 191 in the first term and 198 in the second term. 46 students appeared for the final year examination for the degree of Bachelor of Science (Agriculture) of which 34 or 73·9 per cent. were successful. Much consideration was given during the year to the intensification of practical instruction in agriculture in the courses at the College and these have now been readjusted and the period of two terms extended by six weeks to enable more time to be devoted to practical training on the College Farm. The revised syllabus has been accepted by the Bombay University and will come into force from the next academic year. Thirteen post-graduate students were engaged on scientific research work under the College staff during the year under report, viz., 5 in Botany, 3 in Entomology, 3 in Chemistry, 1 in Horticulture and 1 in Plant Pathology.

Special courses in crop production, veterinary science, horticulture, entomology, plant pathology and chemistry were attended by twelve students. The special Forest Rangers Course instituted by Government for the training of Forest Rangers in the Province, was continued and all the students in attendance, viz., 8 completed the course and passed out successfully. This course has now been extended for a further period of two years and a second batch of ten students are now under training six of whom are Government nominees, two nominated by Indian States and two private candidates.

A training class in agriculture for junior officers in the Revenue Department was held for ten days in September 1939 and was attended by six Assistant and Deputy Collectors.

The College activities in connection with the University Training Corps, Students Co-operative Stores, Sports, etc., continued with success during the year under report. The College library was extended and a new system of classification and catalogueing of books was introduced.

The numerous and varied activities of the expert staff of the Agricultural College in connection with scientific research and advice and assistance to the public are dealt with in detail in the sections of this Report and its Appendices dealing with these subjects.

(74) *District Agricultural Schools.*—The Marathi Agricultural School at Dhulia and the Kannada Agricultural School at Devi-hosur continued to be administered and directed by the Agricultural Department during the year under report. The popularity of these institutions and their importance in agricultural education in the Province is evident from the number of applications received from the districts in which they are situated for admission for training. The Agricultural School at Dhulia has now completed its 16th year. 181 applications for admission were received from the districts of East Khandesh, West Khandesh and Nasik during the year, of which 21 students were admitted on the recommendation of the Local School Committee. The total strength of students under training was 40, 21 in the first year and 19 in the second year of the two years' course of instruction. The training given continued to be on definitely practical lines. Fruit, flower and vegetable gardens have been developed. Practical training in carpentry, smithy work, management and upkeep of oil-engines, compost making, poultry farming, etc., were given to the students. In addition, they received theoretical and practical training in agriculture at the School Farm. Much credit is due to the Local School Committee, under the chairmanship of Rao Saheb B. R. Ransing, B.A., LL.B., for their interest and industry in all matters affecting the welfare of the students and the development of the school.

The Kannada Agricultural School at Devi-hosur had also a successful year's working to report. Thirty students attended of which 15 were in the first year and an equal number in the second year. In addition, training was given to two teachers deputed by the Bijapur School Board for instruction to fit them to take charge of Agricultural Bias classes in the Bijapur district. The total number of students who have successfully completed their agricultural training at this school now amounts to 300 and 39 primary school teachers have also received instruction in agriculture at this centre. This institution serves the Dharwar, Belgaum and Bijapur districts where it is carrying out most useful work in practical agricultural education.

(75) *Agricultural Bias Classes.*—These classes, which aim at imparting an agricultural bias to education in village schools, are under the control and administration of the Educational Department. The local officers of the Agricultural Department, however, maintain a close interest in the working of these classes and are responsible for periodic inspections and examinations. In the Southern Division, agricultural classes were attached to the two High Schools at Satara and Bijapur and, in the Northern Division, to the High School at Godhra.

(76) *Special Agricultural Training Courses.*—During the year under report, considerable progress was made in the development of special training classes in different aspects of agriculture, e.g., poultry farming, horticulture, etc. These classes are primarily intended for cultivators and are becoming increasingly popular. The special horticultural training class held at the Ganeshkhind Fruit Experimental Station, Kirkee, attracted a large number of applicants from all over the Province and 80 students were admitted. Only seven of these failed to reach the standard laid down at the test examination held in March 1940. Four students attended a course in fruit preservation.

Fifty-three students joined the special poultry training class held at the Government Central Poultry Farm, Kirkee, of which 47 students successfully completed the course and were awarded certificates. In addition, the District School Boards of West Khandesh and Thana deputed teachers for training in village poultry management. Eight students have joined a similar course at the Government Poultry Farm, Dhulia. A class for intensive training in the technique of scientific field bunding, etc., against soil erosion was held at the Agricultural College, Poona, for a period of 2½ months in the cold weather season of 1939. 20 cultivator students attended and instruction was given by the Professor of Agricultural Engineering, Physics and Mathematics, and a special staff. Men trained in this way will be most useful in the extension of bunding schemes in the districts from which they were deputed for training.

The Agricultural Engineer held an oil engine training class at which 11 students were trained in the upkeep and management of oil engines for agricultural purposes.

CHAPTER VI.

ADMINISTRATION AND FINANCE.

(77) *Introduction.*—At the beginning of the year under report, the decision of Government to transfer all district propaganda and demonstration work in connection with the extension of agricultural improvement to a newly formed Rural Development Department was given effect to and, in consequence, the district staff of the Agricultural Department, formerly occupied with such work, was handed over to the new Department under the control of the Registrar of Co-operative Societies and Director of Rural Development. As a result of this re-organization, the activities of the Agricultural Department during the year were entirely confined to scientific research work, livestock and animal husbandry in all its aspects and agricultural education. Notwithstanding the elimination of district propaganda and demonstration work from the functions of the Agricultural Department, the rapid development of scientific agricultural research in crops and livestock, the increased demand for technical training in various branches of agriculture and the expansion of the widespread and intensive campaign of rural development and village uplift have fully occupied the time and energies of all the staff of the Agricultural Department. It is becoming more generally recognised among the public that scientific research work is at the basis of all agricultural development and advance and that the services of the expert technical officers of the Agricultural Department are essential to the effective development of a " better farming " campaign in the districts of the Province in the endeavour to improve the economic conditions of the cultivators. The outbreak of the World War towards the close of 1939 has given rise to many important problems in connection with the future development of agriculture in the Province. While old markets for agricultural produce have been lost, temporarily at least, new markets have been opened and the planning of crop production to meet the changing demands of consumption, both internal and external, resulting from the economic disturbance of War is a matter to which expert conside. ation is essential. Throughout India, a much greater degree of co-ordination in scientific agricultural research work has been achieved as a result of the efforts of such bodies as the Imperial Council of Agricultural Research and the Indian Central Cotton Committee. The enhancement of public interests in livestock improvement has been most marked during the past

few years. All these developments, added to the reorientation of agricultural policy which the War must inevitably demand, must throw an increased responsibility upon the staff of the Agricultural Department and make a greater demand upon their industry and energy. The work of the officers of the Department in all grades during the year under report gives sound reason for confidence that they will continue to bear with willingness and efficiency whatever duties the future may call upon them to perform in the interests of the cultivators of the Province.

A. Administration.

(78) (1) *Staff.*—Mr. W. J. Jenkins, Director of Agriculture, was on leave out of India from 2nd December, 1939, to 20th March, 1940. During this period, Mr. B. S. Patel, Principal, Agricultural College, Poona, officiated as Director of Agriculture. Dr. G. S. Cheema, Horticulturist to Government, officiated as Principal, Agricultural College, and Mr. K. S. Kulkarni, Assistant Professor of Agriculture, as Professor of Agriculture, in the place of Mr. B. S. Patel during the period that officer acted as Director of Agriculture.

On return from leave, Rao Bahadur S. S. Salimath was posted as Deputy Director of Agriculture, Northern Division, Mr. H. G. Baluch being posted as Deputy Director of Agriculture, Southern Division.

Mr. B. S. Kadam, Crop Botanist to Government, continued on leave out of India during the year under report. Mr. M. L. Patel, Cotton Breeder, Surat, who was appointed to officiate as Crop Botanist to Government during Mr. Kadam's absence on leave, himself proceeded on leave for four months during which period Mr. V. M. Chavan, Assistant Professor of Botany, Agricultural College, officiated as Crop Botanist to Government.

During the year under report, Mr. M. L. Patel was appointed as Cotton Breeder, North Gujarat; Mr. G. B. Patel as Cotton Breeder, South Gujarat and Rao Saheb S. H. Prayag as Cotton Breeder, Southern Maratha Country.

Mr. A. A. Vasawada was appointed to act as Professor of Agricultural Engineering, Physics and Mathematics, Agricultural College, in place of Professor J. P. Trivedi, on deputation as Secretary, Institute of Agriculture, Animal Husbandry and Dairying, Anand, Gujarat.

(79) (2) *Retirements.*—During the year under report, Mr. V. V. Gadgil, Principal Agricultural Officer, Sugarcane Research Scheme, Padegaon, was permitted to retire from service in the Agricultural Department on the expiry of leave for three months from 4th March, 1940. Mr. Gadgil joined the Agricultural Department in 1909 and, after serving in various capacities in the districts as District Agricultural Overseer, Farm Superintendent, Divisional Superintendent of Agriculture and Deputy Director of Agriculture, was appointed as Principal Agricultural Officer, Padegaon, in November 1938 which position he held up to the time of his retirement.

Mr. K. V. Joshi, who was formerly Deputy Director of Agriculture, North Central Division, and who had served in the Agricultural Department for 30 years before being transferred to the Rural Development Department as Deputy Director of Rural Development also retired from service during the year under report.

The best wishes of their colleagues in the Agricultural Department follow these two officers into their well-earned retirement.

(80) (3) *Obituary.*—The scientific side of the work of the Agricultural Department, especially in connection with botanical and plant-breeding work on cotton, suffered a severe loss with the sudden and untimely death of Mr. A. K. Shah, officiating Cotton Breeder, North Gujarat, in March, 1940. After graduation at the Agricultural College, Poona, in 1920, Mr. Shah joined the ranks of the Agricultural Department and the whole of his service was devoted to scientific research work on cotton improvement. As a result of his experience and industry, he was appointed to officiate as Cotton Breeder, South Gujarat, in April, 1939, and was transferred to the similar post in North Gujarat shortly before his lamented death. Mr. Shah was a young man of much promise and the Agricultural Department loses a valuable scientific officer by his premature death.

(81) (4) *Discipline.*—There were no cases of corruption in the Agricultural Department during the year under report.

B. Finance.

(82) (1) *Departmental Expenditure and Receipts.*—The expenditure of the Agricultural Department for the year under report was Rs. 9,81 022 as against 12,54,075 in the previous

year. The decrease was mainly due to the transfer of the district propaganda staff, including the marketing section of the Agricultural. Department, to the Rural Development Department under the reorganisation scheme approved by Government under Government Resolution, Revenue Department, No. 15/33, dated 8th March 1939.

The receipts of the Department amounted to Rs. 2,28,490 as against Rs. 2,29,382 in the preceding year, the small decrease being due to the transfer of the district propaganda activities to the Rural Development Department.

(83) (2) *Subsidies and Grants.*—The subsidies and grants noted below were placed at the disposal of the Director of Agriculture during the year 1939-40 for approved schemes of agricultural research, multiplication of improved seeds, live-stock improvement and similar activities by the :—

1. Imperial Council of Agricultural Research and Sugar Excise Fund,
2. Indian Central Cotton Committee,
3. Sir Sassoon David Trust Fund,
4. Grants made by the Central Government for schemes for Economic Development and Improvement of Rural Areas,
5. Donations to His Excellency the Viceroy's Livestock Improvement Scheme.

1. (A) *Imperial Council of Agricultural Research :—*

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
1. *Sugarcane Research Scheme*	79,125	79,004
Total ..	79,125	79,004
Deduct Government contribution	—19,801	—18,740
Deduct Contribution from the Sugar Excise Fund ..	—20,762	—20,762
Net grant from the Imperial Council of Agricultural Research ..	39,562	39,502

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
2. *Dry Farming Research Scheme*	46,172	46,009
Total ..	46,172	46,009
Deduct—Government contribution	—15,836	—15,836
Net grant from the Imperial Council of Agricultural Research ..	30,336	30,173
3. *Cold Storage Research Scheme*	17,635	16,508
Total ..	17,635	16,508
Deduct—Government contribution	—550	—550
Net grant from the Imperial Council of Agricultural Research ..	17,085	15,958
4. *Poultry Research Scheme*	7,035	7,018
Total ..	7,035	7,018
Deduct—Government contribution	—33	—33
Net grant from the Imperial Council of Agricultural Research ..	7,002	6,985
5. *Sheep Breeding Scheme*	8,718	8,071
6. *Sann Hemp Cultivation scheme*	680	680
7. *Scheme for Investigations into Virus Diseases of Plants* ..	10,183	10,087
(Works) ..	+638	+638
Total ..	10,821	10,725

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
8. *Scheme for Investigations into Striga attacks on Jowar* ..	12,127	11,017
Total ..	12,127	11,017
Deduct—Government contribution	—2,425	—2,203
Net grant from the Imperial Council of Agricultural Research ..	9,702	8,814
9. *Sugarcane pests Scheme*..	3,525	3,502
10. *Milk Recording Scheme*	840	774
Total ..	840	774
Deduct—Government contribution	—420	—387
Net grant from the Imperial Council of Agricultural Research ..	420	387
11. *Scheme for testing the reaction of wheat to blackstem wheat rusts*	11,286	11,280
Total ..	11,286	11,280
Deduct—Government contribution	—884	—884
Net grant from the Imperial Council of Agricultural Research ..	10,402	10,396
12. *Definition of Breed characteristics of certain breeds of cattle*	1,000	752
13. *Scheme for Training of a Special Tobacco Officer abroad* ..	700	603
Total net grant from the Imperial Council of Agricultural Research	1,39 953	1,36 548

1. (B) *Sugar Excise Fund.*

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
(1) Scheme for control of grasshopper pest on Pravara and Godavari Canals	20,705	17,261
Total net grant from the Sugar Excise Fund ..	20,705	17,261

2. Indian Central Cotton Committee.

Name of the scheme.	Grant 1939-40.	Expenditure 1939-40.
	Rs.	Rs.
1. Broach Cotton Breeding Scheme	10,542	8,469
2. Jalgaon Cotton Breeding Scheme	6,766	5,268
3. Banilla Seed Distribution Scheme	263	263
4. Technological Assistant, Gujarat	3,976	2,667
5. Cotton Forecast Improvement Scheme	4,702	4,377
6. Revised Jaywant Cotton Seed, Stage II	1,000	985
7. Revised Jaywant Gadag No. 1, Stage II	390	369
8. Clerk for Bombay Schemes	1,680	1,622
9. Cotton Wilt Breeding Scheme, Poona	7,726	6,428
10. Cotton Wilt Breeding Scheme, Surat area	2,730	2,383
11. Dholleras Wagad Cotton Improvement Scheme at Viramgam	4,815	4,482
12. Jarila Seed Distribution Scheme, Stages I and II ..	3,302	3,185
13. Inclusion of Northern and Western Cottons at Bijapur ..	2,094	2,004
14. Interspecific Hybridization on Cottons at Surat ..	2,491	2,325
15. Scheme for the Maintenance of Nucleus of Improved Varieties of Cotton Seed	2,400	1,907
Total ..	54,877	46,734

3. *Sir Sassoon David Trust Fund (1939-40).*

	Rs.	a.	p.
(*a*) Further grant for the investigation in connection with the improvement of grass lands ..	356	0	0
(*b*) Further grant for linseed breeding scheme ..	2,337	0	0
(*c*) Further grant for oil-seed breeding scheme ..	1,540	0	0
(*d*) Further grant for the research work on the wilt disease of sann hemp	2,085	0	0
(*e*) Scheme for the study of Betal Vine Bug ..	2,533	0	0
(*f*) Egg-marketing scheme in Belgaum District ..	133	0	0
(*g*) Further grant-in-aid to the Dhulia Agricultural School	500	0	0
(*h*) Scheme for the study of the rate of availability of phosphates for plants in typical soils of Western India	1,825	0	0
(*i*) Scheme for study of the grape vine beetle ..	2,620	0	0
(*j*) Grant for erecting an Insectory for the Grape-vine and Beetlevine Bug Schemes ..	3,000	0	0
Total ..	16,929	0	0

4. *Village Improvement Schemes.*

(Grants made by the Central Government.)

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
(1) Scheme for the improvement of Poultry in villages ..	2,700	2,609
(2) Scheme for encouragement of Pedigree Poultry keeping in villages	600	600
Total ..	3,300	3,209

5. *His Excellency the Viceroy's Livestock Improvement Scheme.*

Division.	Total amount of donations received from the start till 31st March 1940.	Expenditure from start till 31st March 1940.	Balance on 31st March 1940.
	Rs.	Rs.	Rs.
Northern Division	62,395	38,703	23,692
Southern Division	25,968	14,769	11,199
Total ..	88,363	53,472	34,891

(84) (3) Personal Ledger Account of the Director of Agriculture :—

The Personal Ledger Account of the Director of Agriculture, amounting to Rs. 1,83,000 was closed under orders contained in Government Resolution, Revenue Department, No. 15/33 of 10th July 1939 and transferred to the Registrar of Co-operative Societies and Director of Rural Development, Bombay Province, Poona, from 1st August 1939. The position of the Account as it stood on 31st July 1939 was as shown below :—

A statement of account of the Personal Ledger Advance of Rs. 1,83,000 as on 31st July 1939.

Serial No.	Liabilities.	Amount.	Serial No.	Assets.	Amount.
1	2	3	4	5	6
		Rs. a. p.			Rs. a. p.
1	Advance ..	1,83,000 0 0	1	Sundry Debtors and closing stock.	32,535 14 5
2	Profit realised in seed transactions.	1,349 9 9	2	Cash on hand on 31st July 1939 at Poona Treasury	1,47,813 11 4
				Surat Treasury ..	4,000 0 0
	Total ..	1,84,349 9 9		Total ..	1,84,349 9 9

W. J. JENKINS,
Director of Agriculture, Bombay Province.

APPENDIX A.

Summary of work done under the Deputy Director of Agriculture, Southern Division, for the year 1939–40.

A. Charge and Staff.

The charge of the Southern Division, now comprising of the nine districts of Poona, Ahmednagar, Sholapur and Satara in the Deccan, Belgaum, Bijapur and Dharwar in the Karnatak, and Ratnagiri and Kanara in the Konkan, was held by Mr. K. S. Kulkarni, Assistant Professor of Agriculture, up to 17th September 1939, as Rao Bahadur S. S. Salimath was on leave on medical grounds. On the expiry of his leave, Rao Bahadur Salimath was transferred to the Northern Division and Mr. H. G. Baluch to the Southern Division and he took over the charge of this Division from Mr. K. S. Kulkarni on 18th September 1940. The control of the Poultry Section on the Dharwar Farm and of the Cattle Breeding Farm at Tegur was transferred to the Live Stock Expert to the Government, Bombay Province, Poona, with effect from 22nd October 1939 and 1st November 1939 respectively.

Mr. S. S. Maralihalli, Agricultural Overseer under the Cotton Breeder, S. M. C., Dharwar, continued to officiate as Cotton Breeder till 24th August 1939, when he was relieved by Rao Saheb S. H. Prayag, who was transferred from Surat to this Division. Mr. G. R. Yadav, Superintendent, Dharwar Farm, was on leave for 3 months and 9 days and Mr. S. L. Lele, Agricultural Overseer on Arbhavi Farm, officiated as the Superintendent, Dharwar Farm, during the leave period. Mr. D. M. Kulkarni, Superintendent, Arbhavi Farm, and Mr. S. K. Patwardhan, Superintendent, Mohol Farm, were on leave for one month, while Mr. V. M. Majmudar, Tobacco Breeder, Nipani, was on leave for 20 days during the year under report. Mr. R. S. Kittur, Agricultural Overseer on Dharwar Farm, was deputed from 25th June 1939 as a teacher-Supervisor of the Agricultural side in the Government High School, Bijapur, and Mr. S. L. Lele, Agricultural Overseer, on the Arbhavi Farm, was transferred to Poona, on 8th March 1940 to work as Laboratory Assistant under the Agricultural Chemist to Government, Bombay Province, Poona. There were no other important changes during the period under report.

B. Season.

The ante-monsoon showers were practically absent over the major part of the Division. The regular monsoon set in about the first week of June. The rainfall in June was insufficient in the eastern parts of South Deccan and the Karnatak, but was somewhat heavy and continuous in South Konkan and hence, Kharif sowings were confined to favourable localities only. Fairly general and substantial rains were received in July and Kharif sowings were carried on vigorously and on an extensive scale, while the young germinated seedlings showed a healthy development. This rain, however, proved rather excessive

in parts of Satara and Belgaum districts where field operations were hindered and the newly sown crops in low-lying areas suffered from over-saturation. There was not, however, sufficient rainfall at the time of transplantation of paddy. The first fortnight of August went dry almost throughout the Division except in the western parts of Karnatak and the crops on lighter soils began to show signs of withering. This situation was fortunately relieved by the most opportune and favourable rains received about the middle of August and again at the end of September and they appreciably improved the general stand of the crops. These rains, however, proved somewhat excessive to the cotton crop in places in East Karnatak and caused "Rhizoctonia" in deep black soil areas. In the eastern tracts of South Deccan and Karnatak, on the other hand, the rain was below requirements and the standing crops in many places deteriorated for want of adequate soil moisture and rabi sowings also were hampered. Rainfall in October was just enough in the South Deccan to keep the matured Kharif crops in good condition and their harvesting had commenced in many places. In parts of Karnatak, however, there were heavy showers that caused suspension of field operations and damage to standing crops in many areas, while in South Konkan these showers came in the way of harvesting paddy along the coastal belt and encouraged "Koleroga" on betelnut. In November there was some good and useful rain. Rabi sowings were in brisk progress and the sown crops were thriving well, as their growth was further stimulated by the setting of favourable cold weather. In eastern parts of Karnatak, however, the crops suffered from want of adequate moisture in the soil, coupled with prevalence of adverse dry easterly winds and occasional cloudy weather conditions. After this, the activity of the monsoon declined, there being only sporadic showers of rain at some places in the Division.

Sugarcane suffered from an attack of grasshoppers and stem-borers in many areas of the Deccan Canals, while rice and Kharif jowar suffered from army-worm-caterpillars, bajri from blister-beetles, rabi jowar from "Chikta" and smut, cotton from "Rhizoctonia" and red-leaf-bilight and groundnut by "tikka" in many places in South Deccan and the Karnatak. Standing crops were also damaged by field-rats in parts of Sholapur and Bijapur districts. Potatoes were affected by "tambera" to some extent, while tobacco had cut-worm and stem-borer attack in some areas of the Division. In South Konkan, crops like rice, nagli and wari were attacked by caterpillars, while betelnut suffered rather seriously from Koleroga in the later part of the season.

C. Research and Investigations.

I. COTTON—COTTON BREEDER'S SECTION.

(*a*) Kumpta Cotton.

Trial of selected strains against local Kumpta.—New Jayawant, Early Jayawant and Jayawant were again tested during the year with the addition of strain 9-1-4, a segregate from [(Jay × N 14) × (Dl × Rosea)

1A-14-3] in six randomised replications. The area of each plot was 1·2 gunthas. Kumpta was used as control. New Jayawant gave significantly higher yield than others except Jayawant. In ginning percentage, it was superior to Jayawant by 4 per cent.

Selections in the following crosses.—(*i*) [(1A-14-3) × (1-0-1)] cross was in the 7th generation. Further selections have been made for high yield, high ginning and long staple. The following lines were found promising. These were, however, susceptible to wilt disease.

1–4–2–4–4
6–2–2–3–5
6–2–4–5–4
8–1–4–1–1

They all gin 35·0 per cent. and possess good staple.

(*ii*) [(Jay × N14) × (1A-14-3)] cross was in F6 generation. Segregates 6-4-1, 9-1-3, 9-1-4 and 10-2-2 were tried in four replications for yield. These were susceptible to wilt. Of these, 9-1-4 has been found promising, the others being low yielders.

(*iii*) [(K.F.T 12-2-5) × New Jayawant]	..	..	F3
(*iv*) [(K.F.T. 12-2-5) × (1A-14-3)]	..	..	F2
(*v*) [(K.W.R. × 2519) × (Early Jayawant)]	..	..	F2

Selections have been made in the above crosses for high yield, ginning percentage, and long staple. Further study of these will be continued.

Fresh Crosses.—With a view to combine wilt resistance and high ginning percentage, the following crosses have been made :—

(*i*) New Jayawant × B.D. 8 back cross F6-1-6,

(F1 to be back crossed with New Jayawant in 1940–41).

(*ii*) K.F. T 12-2-5 × B.D. 8 back cross F6-1-6,

(F1 to be back crossed with New Jayawant in 1940–41).

(*iii*) [K.W.R. × 2519) × Early Jayawant],

(F1 to be back crossed with K. F. T12-2-5 in 1940–41).

(*iv*) [(K.F. T12-2-5) × (1A-14-3)],

(F1 to be back crossed with 1A-14-3 in 1940–41).

It is proposed to abandon cross No. (*iii*) as the study of F2 of this cross which was done in the past has not given any promising results and the introduction of the blood of K.F. T12-2-5 is likely to deteriorate its ginning percentage still further. Attention will be concentrated on cross No. (4), as it is likely to lead to the desired result.

Wilt Resistance.

(*i*) *Behaviour of wilt resistant cottons in the field.*—Twenty different varieties of cotton were sown in a plot in which high incidence of wilt had been recorded in previous years. Wilted plants were counted every week. The results have again proved that K.F. T12 and T14 are homozygous for wilt resistance.

(*ii*) *Behaviour of wilt resistant cottons in the green-house.*

In the green-house, the progeny of the ten selected individuals of the F2 of (New Jayawant × K.F. T12-2-5) cross was sown in pots, filled with infected soil and the performance was observed for 45 days. None of plants escaped leaf-mottle.

Four plants had to be rejected because of the high incidence of wilt in their progeny. Eighty selected plants were transplanted out of the progeny of the remaining six plants, after testing for 45 days in the green-house for wilt resistance. An examination of all these transplants revealed that the study of the cross would not lead to the desirable result on account of the low ginning percentage. Fresh crosses have, therefore, been made with the object of combining wilt resistance with high ginning percentage.

(*b*) American Cottons.

Trial of the promising segregates.—The promising segregates 4–4–1–1, 9–7–6–6 and 12–6–4–2, of the cross between Gadag 1 × CO II, were tried both at Dharwar Farm and at Gadag plot during the year, each on a guntha plot, the number of replicates used being four in the former place and six in the latter. The segregate 9–7–6–6 gave significantly higher yield than others at both the places. Its ginning percentage was 37·2 and staple length was 27 mms., as compared to 33·1 and 24 mms. respectively of Gadag I. The other segregate was found to be earlier than Gadag I by about three weeks. Both the strains have shown greater resistance to Red-leaf-blight than Gadag I.

Trial of Inter-Specific Crosses.—Seeds of 64 individual plants, sent from Surat, were tried at Gadag plot during the year. In the selfed progeny of Back-cross No. 22, culture number 5-12 seemed promising from the point of earliness, yield, staple quality, ginning percentage and red-leaf-blight resistance. The progeny of selfed seeds from some of the individuals will be closely observed.

In the majority of cases, the boll opening was defective and was markedly late. These two factors may be detrimental to the success of most of the cultures which are in heterozygous condition. There is also a tendency towards unevenness of the fibre length in the majority of plants.

Crossing.—With a view to increase the length of staple of the segregate 9–7–6–6 of Gadag I × CO II, a cross has been made between 9–7–6–6, and G. peruvianum.

(F1 to be back crossed with 9–7–6–6 in 1940–41).

Selfed seed.—Selfing was done as usual in Jayawant and Gadag 1 cotton. The quantity of selfed seed obtained was 284 lbs. in the case of Jayawant and 650 lbs. in the case of Gadag I cotton.

Spinning test.—Ten samples of different strains were sent to the Director, Technological Laboratory, Matunga, for spinning performance. Of the G. herbaceum cottons, Jayawant gave the highest counts, viz., 38's and of the Dharwar American cottons 9–7–6 gave 5 counts more than Gadag I.

Dharwar Farm.

(*a*) *Varietal trials.*—The promising varieties of cotton, viz., Jayawant, New Jayawant and Early Jayawant were compared with Kumpta, each variety being grown on 1·3 guntha plot and randomised six times. New Jayawant was found to be significantly superior to Jayawant and Kumpta. No significant difference was, however, noticed between Early Jayawant and Kumpta.

(*b*) *Manurial trials.*—(*i*) G. herbaceum cotton in Karnatak does not, as a rule, receive direct manuring. To ascertain if F. Y. Manure, given in different doses, has any beneficial effect on cotton crop, an experiment was laid out during the year, each treatment being on 2·1 gunthas and randomised six times. The treatments were—(1) F. Y. M. 2½ tons every year to cotton, (2) F. Y. M. 2½ tons every second year to cotton, (3) No manure, (4) F. Y. M. every second year to the rotation crop, viz., Jowar. The results have been in favour of application of 2½ tons F. Y. M. every year, this being significantly superior to other treatments.

(*ii*) *The sann green-manuring trials consisting of* (1) sann alone, (2) sann + F. Y. M. 1,500 lbs. per acre, (3) 2½ tons F. Y. M. alone, and (4) No manure at all, were conducted each on 1·4 guntha plot and randomised five times. No significant difference between any of the treatments was noticed during the year.

(*c*) *Cultural trials.*—To ascertain if economy could be achieved in the cost of ploughing of lands without affecting the yields of the subsequent crop, an experiment with the treatments (1) ploughing once a year, (2) ploughing once in two years, (3) ploughing once in three years, and (4) no ploughing at all, but, only harrowing, was conducted, each treatment being on 2·8 gunthas plot and replicated six times. None of the treatments have shown any significant superiority.

Arbhavi Farm.

Varietal trials.—As in the previous year, the varieties of cotton, viz., CO II and (GI × CO II) segregate 9–7–6, were again tried during the year. Though CO II gave 40 lbs. more yield per acre than the segregate, there has been no significant difference. The experiment is being repeated.

KOPARGAON FARM.

Varietal trials.—Banilla was tried against Jarila each on a five gunthas plot and replicated six times, according to Student's method. No significant difference was noticed between the varieties and this has confirmed last year's results.

II. PADDY.

(1) MUGAD RICE BREEDING STATION.

(*a*) *Dodagya strains.*—This is the fifth year of the trial, the same 7 strains being tried as in the previous year. Strain 6–2–2 gave significantly superior yield to local Dodagya. The five years' results have indicated that strains 5–1–1, 6–2–2 and 6–2–3 have consistently given promising results and these three selections only will be tried during the next year, the others being discarded.

(*b*) *Trial of some non-Bombay rices.*—As in the previous year, the same five promising varieties of paddy were compared with Mugad No. 141 and Sannabhatta, a local fine variety. None of the varieties showed significant superiority over M. 141. G.E.B 24 gave superior yield as compared to Sannabhatta. The five years' results have indicated that Luchai, though nearly equal in yield to that of M. 141, in all the five years, possesses the defect of grain shedding and Indrasal though superior in yield as compared to Sannabhatta, in three out of five years, is very late. The experiment is thus discontinued.

(*c*) *New selections from Dodagya rice.*—The 18 selections of the previous year were tested in rod-row cultures and were replicated ten times. Local Dodagya was used as control. Only six of the selections gave promising results and will be retained for further trial.

(*d*) *Selections in local fine rices.*—3 very early, 4 early, 6 midlate, 9 late and 13 very late types selected in 1938-39 were tried in the year under report and of these 2 early, 3 mid-late, 5 late and 6 very late types have been further selected for field trials in 1940-41.

(*e*) *Antersal No. 200.*—The five strains of Antersal variety mentioned last year were tried against Antersal 200 to ascertain if any of the strains would give the desired yield. Strains Nos. A. 267 and A. 176 gave yields equal to A. 200 and have been retained for further trial, the rest being discarded.

(*f*) *Crosses.*—(*i*) To evolve early, midlate and late strains of intense purple colour of stem and leaves and combining high yield, crosses were made between purple rice and each of the following varieties—

(*a*) M. 161 (early), (*b*) M. 141 (late), (*c*) A. 67 (early), (*d*) A. 200 (late) and (*e*) Luchai (late).

(*ii*) To evolve higher yield and scented rices, the following crosses were made—

(*a*) P. R. 50 × Luchai, (*b*) P. R. 50 × A. 200, (*c*) P. R. 90 × Luchai, (*d*) P. R. 90 × T. 24.

(*iii*) The third set of crosses was done with a view to evolve types for the top-most lands and scanty rainfall tracts. Antersal 11 and T. 18 were each crossed with D. 6-2-3, a coarse drought resistant and very early type.

(2) Kumta Farm.

(*a*) Earlies.

Maskaty 1315 Vs. Rajakavam, Tavalakavam and Rangoon.—This is the third year of the trial and the results have indicated that Rangoon and Tavalakavam varieties gave increased paddy yields of 30·3 and 32·9 per cent. over that of 1315, which has been the earliest of all. Rajakavam being inferior in yield has been omitted from the next year's trials.

(*b*) Midlates.

Jeddu 1061.—This when compared with Jeddu local gave 17·7 per cent. of increased paddy and 11·5 per cent. of increased straw yields. The results are thus confirmatory to those of the previous years.

(*c*) Lates.

Red Halga No. 244.—This when compared with local Halga and Muginbeldu gave 17·7 per cent. more grain and 20 per cent. more straw over local Halga and 26 per cent. more grain and 37 per cent. more straw over Muginbeldu. The results have confirmed those of the previous years.

(*d*) Selections from Bulk samples of Karwar-Ankola zone.

From the collections of the bulk samples of Sannamalliga, Bile-Akka, Sanna-pandya and Dodda-pandya varieties from Karwar-Ankola zone, 511 plants were selected. These will be tested for further study in 1940–41.

(*e*) Yield Trials.

(*i*) *Muginbeldu strains.*—Of the seven strains tested in six replications against local Muginbeldu, five, viz., 125, 153, 159, 169 and 230 gave grain yield significantly superior to that of the local. None of the strains gave increased yields either grain or straw over Halga 244 which had also been included in the trial. This is the third year of the trial. The experiment will be repeated.

(*ii*) *Upghat white Halga.*—The same six strains tried during the year gave increased grain yields varying from 17 to 38 per cent. The five years' results have indicated that strain No. 1690 has consistently given better yields of grain and straw than other strains. The other strains that stand next in order are 1691 and 1681. Further trials of these will be discontinued.

(3) Ratnagiri Farm.

The work on rice is confined to the maintenance of the purity of the strains already evolved and their multiplication.

(4) Paddy Seed Multiplication on Mugad, Kumta, and Ratnagiri Farms.

The quantity of seed multiplied and given for distribution from each of the farms is as under:—

Mugad Farm.			Kumta Farm.			Ratnagiri Farm.		
Variety.	No.	Lbs.	Variety.	No.	Lbs.	Variety.	No.	Lbs.
Antersal early.	67	185	Muskaty ..	1315	2,000	Patni early ..	6	2,086
Antersal mid-late.	90	297	Jeddu ..	1061	3,000	Panvel mid-late.	61	2,789
Antersal late ..	200	1,041	Red Halga ..	244	7,000	Waksal mid-late.	207	3,370
Mugad early ..	161	669	White Halga..	1,090 1,681	150 160	Kolamba mid-late (fine).	184	460
Mugad midlate.	81	500				Kolamba mid-late.	401	3,274
Do. ..	249	175				Bhadas late ..	79	197
Mugad late ..	141	959						

III. SUGARCANE.

(1) Kopargaon Farm.

(*a*) *Varietal trials.*—To ascertain the suitability of varieties for adsali and mid-adsali planting, an experiment was carried out in six varieties, each being grown on half a guntha plot and randomised six times. The varieties selected were as under:—

Adsali planting (*July*)		*Mid-adsali planting* (*October*)
1. Co. 419	..	1. Co. 419
2. Co. 413	..	2. Co. 413
3. Co. 290	..	3. Co. 290
4. E.K. 28	..	4. Co. 407
5. C.O. 360	..	5. Co. 408
6. P.O.J. 2878		6. P.O.J. 2878.

E.K. 28 being very poor in growth and yield had to be rejected. CO. 419 had topped the rank in both the trials, though there was slight lodging. The gul of this variety was not of golden yellow colour like that of CO. 408. CO. 419 gave the best ratoon, E.K. 28 being the poorest in this respect.

(*b*) *An experiment to see which variety would suit the tract and give the best ratoon when planted in January.*—This experiment was started last year. The same six varieties mentioned for Adsali planting had been used, the area for each variety and the number of replications being the same. In the previous year CO. 419 gave yield significantly superior to the rest, while during the current year CO. 419 and CO. 413 were found superior to others, both as plant-cane and as ratoon crop.

(*c*) *Manurial trials.*—With the object of ascertaining the best proportion of sulphate of ammonia to cake in the total quantity of nitrogenous top-dressing given to sugarcane, viz., 300 lbs. of N. per acre, four different proportions were tried in 1938–39 in six replications on a guntha plot each, the variety of cane used being CO. 419. No significant effect due to various proportions of top-dressing was noticed in 1938–39 but during the year under report, where the proportion of nitrogen in sulphate of ammonia to that in cake was 1 : 2, the results have been significantly superior to that of 1 : 1.

(*d*) *Water-cum-manure experiments.*—The object of this experiment is to see the effect of different quantities of water given to sugarcane in combination with varying doses of nitrogenous top-dressing. This is the second year of the experiment and the following six treatments were tried in six replications on a guntha plot each, the variety being CO. 419.

(*i*) 95 acre inches + 225 lbs. N.
(*ii*) 95 acre inches + 300 lbs. N.
(*iii*) 95 acre inches + 375 lbs. N.
(*iv*) 130 acre inches + 225 lbs. N.
(*v*) 130 acre inches + 300 lbs. N.
(*vi*) 130 acre inches + 375 lbs. N.

Last year, treatment (*vi*) was significantly superior to that of (*iv*) and the current year's results have given similar indications. The experiment is repeated.

(*e*) *Rotational series.*—3, 4 and 5 year rotational experiments started in 1938–39, have been continued and will be reported after the completion of the series.

(2) Arbhavi Farm.

(*a*) *Varietal trials.*—The CO varieties, viz., Nos. 413, 141, 419 and 421 were tried again during the year, the control being J. 213. CO. 419 gave 14,880 lbs. of gul per acre as against 13,844 lbs. of J. 213. The

trial which was being conducted according to Student's method, for the two years will be done according to Fisher's method of randomisation from 1940–41.

(b) Better rotting of Sann-hemp green manure.—The treatments mentioned in the previous report were slightly modified. These were *(i)* 25 carts F. Y. M., *(ii)* sann *plus* 5 carts F. Y. M. before sowing, *(iii)* sann + 5 carts F. Y. M. before burying sann and *(iv)* sann alone. The variety of cane planted was CO. 419. The results are awaited.

(3) Kumta Farm.

(a) Varietal trials.—Four CO. varieties, viz., Nos. 400, 402, 413 and 421 and two H. M. types, Nos. 87 and 300, were tried again with H. M. 544 and Red Mauritious as controls. The current year's results indicated that CO. Nos. 413, 400 and 402 and H. M. 320 gave increased yields of gul of 28, 22, 35 and 4 per cent. respectively as compared with Red Mauritious.

IV. TOBACCO.

(1) Nipani Farm.

(a) Selections in local tobacco.—The 36 selections reported last year and composed of 29 from the Surti variety, 4 from the Baglani variety and 3 from the Bhopli variety, were studied during the year for their purity and agronomic characters. Of these 8 from Surti, 1 from Baglani and 1 from Bhopli were further selected as promising types.

The 27 samples collected last year from the local material were grown and of the 220 plants selected on the basis of economic characters, only 37 plants were retained for further study.

Fresh exploration was made during the year and 15 individual collections were made.

(b) Trial of varieties brought from outside places.—Nadiad No. 6, N.R. No. 18 and two varieties from Guntur (Madras Province) were introduced and given preliminary trial. Nadiad 6 was dwarf in size, N.R. 18 was a low yielder and the Guntur varieties, viz., Thokaku and Karraku were late in flowering and were not considered to be useful for the tract.

(d) Cigarette tobacco.—Seeds of 11 varieties were brought from different places and were tried. As the flue-curing barn could not be built during the year, the leaves were air-cured, turned into powder and sold in the local market. These varieties will be tried during the next year if the flue-curing barn is constructed.

(d) Varietal, spacing and topping Experiments.—Three varieties, viz., Harrison Special, Gold Dollar and Bonanza were tried at distances of 42″ × 42″ (local system), 36″ × 36″ and 30″ × 30″. In one series topping was done and in another they were not topped. The lay out of this

experiment was designed in consultation with the statistician of Imperial Council of Agricultural Research. There were six replications. The results showed that 30″ × 30″ spacing was found significantly superior to the other spacings both in topped and in non-topped series and that topping was found to give a lower yield than that of non-topped.

Note.—The varietal trials on Dharwar Farm were discontinued owing to the opening of a tobacco breeding station at Nipani, as per instructions from the Director of Agriculture.

V. GROUNDNUT.

(1) Dharwar Farm.

(*a*) *Varietal trials.*—(*i*) Spanish peanut No. 5 was compared with Spanish Improved according to Student's method, in six replications, the size of each plot being 1·1 guntha. Spanish Improved gave significantly higher yield than strain No. 5.

(*ii*) The above experiment was carried out in another field with the addition of valencia, each variety being grown on one guntha and replicated five times. Spanish Improved was significantly superior to Strain No. 5, whereas Valencia was found significantly superior to both Spanish Improved and Strain No. 5. The results are quite contrary to those of the previous year.

(*iii*) Six strains, viz., A. H. Nos. 113, 218, 477, 334, 186 and 45 received from the oil seed specialist, Coimbatore, were compared with Pondicherry, each in 4/9ths of a guntha plot and replicated seven times, the layout being Latin Square. This is the second year of the experiment. The results showed that A.H. 113 gave significant superiority over the others except A.H. 477 while A.H. 186 was found superior to A.H. 334, A.H. 45 and A.H. 218 but not to Pondicherry and A.H. 218 stood last in yield.

(*b*) *Spacing.*—With a view to ascertain the proper spacings, Spanish Peanut was tried in—

(*i*) 6″ × 4″, (*ii*) 9″ × 6″ as against 12″ × 9″ spacing, each being grown on $\frac{3}{4}$ of a guntha plot and replicated five times. The seed was dibbled at the required distance. Spacing 6″ × 4″ gave significant superiority over others and spacing 6″ × 9″ proved superior to 12″ × 9″.

(2) Kopargaon Farm.

(*a*) *Variety trials.*—Six strains, viz., A.H. 45, 186, 477, 218, 334 and 113 sent from Coimbatore were compared with (Kopargaon) K. No. 1, the lay-out being Latin-square. This is the second year of the trial. Last year A.H. 113 had given significantly superior yield over A.H. 186, A.H. 477 and K. No. 1, but, during the year, K. No. 1 has out-yielded A.H. 113.

VI. JOWAR.

(1) Mohol Farm.

(*a*) *Varietal trials.*—(*i*) Three Maldandi strains, viz., 35-1, 47-3 and M-9 were compared with the local, each being grown on a guntha plot and replicated four times. Despite the unfavourable season strain No. 35-1 gave 9 per cent. increased grain yield over the local.

(*ii*) Among the Dagadi strains, four, viz., N.D. 15, B.D. 24, B.D. 29 and B.D. 34 were tried against the local Dagadi, each being grown on a guntha plot and replicated four times. Strains B.D. 24 and 34 gave 19 and 4 per cent. increased yields respectively over the local.

(*iii*) Nine sub-cultures of Maldandi strain No. 35-1 are under preliminary yield trials and are also studied for earliness and other economic characters.

(2) Dharwar Farm.

(*a*) *Manurial trials—To ascertain the most economic dose of F. Y. M. to Jowar crop.*—An experiment was laid out during the year, each treatment being on 1·6 guntha plot and replicated six times. The treatments were—

(*i*) F. Y. M. 2½ tons, every year to Jowar, (*ii*) F. Y. M. 2½ tons, every second year to Jowar, (*iii*) No manure at all, any year, (*iv*) *F. Y. M.*, every second year to the rotation crop, viz., cotton. 2½ tons *F. Y. M.*, every year has given results significantly superior to other treatments.

(*b*) *Cultural trials—To ascertain if economy could be achieved in the cost of ploughing of lands without affecting the yields of subsequent crop.*—An experiment with the treatment (*i*) ploughing once, a year, (*ii*) ploughing once in two years, (*iii*) ploughing once in three years and (*iv*) no ploughing at all but only harrowing, was conducted, each treatment being on 2·8 guntha plot and replicated six times. None of the treatments have shown any significant superiority.

(*c*) *Spacing experiments—To see whether wider distance has any advantage of yield over drilling.*—An experiment of dibbling (15″ between rows and 4″ between plants), hill sowing (15″ between rows and 18″ between plants, there being 3 to 4 seeds at each hill) as against drilling was tried, each on a guntha plot according to Student's method. None of the treatments have shown any significant superiority. The experiment is discontinued as it was not found to be of practical utility.

Note.—The strains of jowar maintained pure by the Cotton Breeder are—(*i*) Chowari, (*ii*) Bilichigan, (*iii*) Ambemohor, (*iv*) Fulgar Yellow, (*v*) Fulgar white and (*vi*) Nandyal.

(3) Kopargaon Farm.

(*a*) *Variety trials.*—Maldandi 47–3 was tried against local, each on 8-guntha duplicate plots according to Student's method. The mean yields of strain 47–3 and local were 39 and 46·5 lbs. respectively but the difference was not statistically significant. This is the second year of the trial.

(*b*) *Green-manuring.*—To see the effect of green-manuring to the rabi-crop of jowar, trials were made with Ran-matki, Patada-Shevra and Sann as green manures. These three treatments were compared with no manure. Each treatment was under 1½-guntha plot and was replicated four times. None of the treatments showed any significant superiority.

VII. GRAM.

Dharwar Farm.

(*a*) *In a highly wilt-infected plot on Dharwar.*—The wilt-resistant strain No. 18–12 was compared with the local according to Student's method, the size of each plot being 1·5 gunthas. The incidence of wilt in the local was 53·9 per cent. and that in strain No. 18–12 was 1·7 per cent. Strain 18–12 gave significantly higher yield than the local.

(*b*) *In another portion of the Dharwar Farm.*—The above experiment was repeated, Burma variety being included in addition. The incidence of wilt in the local, Burma and strain 18–12 was 5, 3 and 2·8 per cent. respectively. Burma has given significantly low yield.

(*c*) During the year, different varieties of gram were brought from various places, viz., Niphad, Dohad, Dacca, Pusa, Nagpur and Burma for test of wilt-incidence in a plot reported to be highly wilt-infected. The varieties that were outstandingly wilt-resistant were strain No. 18–12, Dohad, Pusa Nos. 53, 58 and 17, Niphad 816 and Burma Nos. 3, 7 and 60.

It is proposed to continue the experiment in an uniformly wilt-infected land.

VIII. TUR.

Arbhavi Farm.

Wilt-resistance in Tur (*Cajanus indicus*).—This work which was continued on Arbhavi Farm has been reviewed by the Plant Pathologist to Government as regards the number of cultures to be grown on Arbhavi Farm and the preparation of wilt compost for establishing a highly infected wilt plot both at Arbhavi and Dharwar farms. The number of cultures to be grown at Arbhavi now numbers 13.

IX. WHEAT.

Dharwar Farm.

(*a*) *Varietal trials.*—The same four varieties tried last year, viz., strain Nos. 808, 193 and Pusa Nos. 111 and 114 were tried on Dharwar Farm, against local hard red wheat, each in a guntha plot and replicated five times. Strain 808 has given yield significantly superior to others except local. It escaped the rust attack being early. Pusa Nos. 11 and 114 were very low yielders and these will be dropped from next year's trials.

(*b*) *Manurial trials.*—To see the effect of sann-green manuring to wheat, the four treatments, viz., (*i*) Sann alone, (*ii*) sann *plus* F.Y.M. 1,500 lbs. per acre, (*iii*) F.Y.M. alone at 2½ tons per acre, (*iv*) no manure, were tried each on a guntha plot and replicated five times. The results have been in favour of sann *plus* F.Y.M. 1,500 lbs. per acre, which treatment has been significantly superior to others.

(*c*) *Cultural experiment.*—To ascertain whether clean cultivation to wheat during the rainy season would in any way be beneficial as compared to cover fallow, trials were made on two-guntha plots according to Student's method. No significant difference was, however, noticed. The experiment is continued with slight modification.

X. MAIZE.

Arbhavi Farm.

The botanical improvement of this crop which is done at Arbhavi Farm was recently reviewed and 31 cultures in all, 11 in earlies, 10 in intermediates and 10 in lates have been extracted for further study.

XI. OTHER EXPERIMENTS.

(1) Kumta Farm.

(*a*) *Tapioca.*—Six varieties were obtained from Travancore State and were tested. Of these Kovilla Vella was found to be the best and Sundary Vella stood next in order.

(*b*) *Pine-apples.*—(*i*) Fertiliser experiments conducted on this crop were the same as those of the previous year. The details regarding the yield are not yet available.

(*ii*) *Varietal trials.*—The same six varieties were tried against Kumta local and Kew variety. The fruits obtained from Mauritious, Pernambuca, Ruby and Natal weighed from 3 to 3½ lbs. as against 7 lbs. of the Kew variety.

(*iii*) *Cultivation of Kew-variety as a dry crop* was done on 6-guntha plot. Well developed suckers of 1½ to 2 feet in height were planted in 2 feet trenches at 5 feet apart between rows and 2½ feet between plants. No irrigation was given. None of the plants have yet fruited.

(*c*) *Cashew-nuts.*—200 more plants were raised during the year in addition to the 96 plants planted in June 1938. The object of this is to see if Bena or sloping semi-soft lands growing poor grass could be made more paying. The results are yet awaited.

(*d*) *Tung Oil* (*Aleoritis gordii*).—Of the 80 plants mentioned last year, 8 plants are dead and the rest are thriving well.

(2) Dharwar Farm.

(*a*) *Varietal trial of chillies.*—The same two varieties, viz., Deccan 9 and Dabkai were again tried against the local "Kasikai", this being the second year of the experiment. The local gave significant superiority in yield over the two varieties which amongst themselves were almost equal but were not found to be genetically pure.

(*b*) *Varietal trial of Mug* (*Phaseolus mungo*).—Two China varieties Nos. 1 and 2 were tried each on a guntha plot and replicated six times. The control was local Mug. China No. 1 gave the highest outturn and China No. 2 stood second. The local failed entirely due to severe attack of mites. This is the second year of the experiment.

(*c*) *Pyrethrum.*—This was tried here in the year 1937–38 and is being grown since then. The plants, however, suffer considerably from fusarium attack and the stand of the plants is poor.

(3) Kopargaon Farm.

Trial of Barseem.—This was sown in November 1939 on an acre plot and the crop gave in four cuttings 11,839 lbs. of green fodder.

(4) Mugad Farm.

Ragi (*Eleusine coracana*).—With a view to select high yielding early, midlate and late types, work on this crop was started during the year at Mugad Farm and 82 samples collected from various places were grown in separate rows. The individual plants selected for further study number 525.

D. PRODUCTION AND SUPPLY OF PEDIGREE SEED AND GRAFTS, ETC.

(A) *The following statement shows the production and supply of pedigree seed, grafts, etc. from the different Agricultural Farms, in the Southern Division during 1939–40.*

Name of seed.	Dharwar Farm.		Mugad Farm.		Arbhavi Farm.	
	Produce.	Supply.	Produce.	Supply.	Produce.	Supply.
1	2		3		4	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1. Rice ..	....	....	10,812	10,043	..	..
2. Wheat ..	8,343	....	....	....	..	..
3. Jowar ..	734	708	....	....	..	..
4. Nilwa ..	....	....	....	....	..	..
5. Nagli ..	....	....	....	....	..	..
6. Gram ..	3,012	....	....	....	..	..
7. Groundnut ..	1,846	1,383	....	....	..	..
8. Sugarcane—sets (in No.)	....	....	....	....	28,945	28,945
9. Cotton ..	....	....	....	....	1,097	1,031
	No.	No	No	No.	No.	No.
10. Lemon seedlings (in No.)	....	....	....	....	3,417	3,417
11. Pomegranate seedlings. (in No.)	....	....	....	....	1,535	1,535
12. Mosambi grafts (in No.).	....	....	....	....	1,184	1,184
13. Guava seedlings (in No.)	....	....	....	....	416	416
14. Mango grafts (in No.)	87	83	....	....	..	..
15. Italian lemon grafts (Nos.)	....	....	....	....	311	311
16. Santra grafts (Nos.)	....	....	....	....	238	238
17. Pine-apple suckers (Nos.)	....	....	....	....	..	..

Name of seed.	Kumta Farm.		Ratnagiri Farm.		Kopargaon Farm.		Mohol Farm.	
	Produce.	Supply.	Produce.	Supply.	Produce.	Supply.	Produce.	Supply.
	5		6		7		8	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1. Rice ..	12,310	12,310	12,700	12,176	..	..	..	..
2. Wheat ..	..	..	..	..	..	120	..	..
3. Jowar ..	..	..	..	..	..	2,992	2,519	2,335
4. Nilwa ..	..	..	..	..	..	493	..	..
5. Nagli ..	..	..	557	549	..	..	..	..
6. Gram ..	..	..	..	..	..	450	..	..
7 Groundnut ..	..	..	..	..	..	..	..	..
8. Sugarcane—sets,	No. 550	No. 550	No. ..	No. ..	No. ..	No. ..	No. ..	No. ..
9. Cotton ..	..	..	..	..	..	..	..	..
10. Lemon seedlings.	..	..	..	..	..	..	..	..
11. Pomegranate seedlings.	..	..	..	..	..	..	..	..
12. Mosambi grafts ..	..	..	..	..	..	..	..	..
13. Guava seedlings	..	..	..	..	..	..	..	..
14. Mango grafts ..	500	500	..	..	..	..	..	..
15. Italian lemon grafts.	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
16. Santra grafts ..	..	..	..	..	..	..	..	..
17. Pine-apple suckers.	4,500	4,500	..	..	..	..	..	..

(B) *Banilla Cotton Scheme on Deccan Canals.*

During the year under report a quantity of 5,337 lbs. of Banilla cotton seed was produced on the Kopargaon Farm, out of which 3,500 lbs. after the treatment of Brine solution were given for multiplication at Sansar, Kanneri and Lassurne on Baramati side.

E. EDUCATION.

I. Agricultural Schools.

Kannad Agricultural School, Devihosur.

The total number of students during the year was 30, there being 15 students in the first year class and a similar number in the second year. In addition, the two teachers deputed from Bijapur School Board were undergoing training for the conduct of Agricultural Bias Classes in Bijapur District. Of the 30 students present, Dharwar and Bijapur claimed 12 each, Belgaum 5 and Karwar only 1. The majority of the students belonged to Lingayat community and one student only hailed from depressed class. The total number of students sent out with certificates now comes to 300 and that of Primary School Teachers reaches 39. The average per head boarding expenses came to Rs. 6–10–11.

The total expenditure of the whole school came to Rs. 7,355–1–3 and the receipts amounted to Rs. 726–7–0.

According to the reorganisation scheme, the school was to be transferred under the control of the Educational Department from 1st April 1940 but on further consideration, Government decided to retain it with the Agricultural Department (*vide* G. M., E. D., No. 6706F, dated 5th April 1940).

Mr. R. B. Patil has been taken up for training in Agricultural Sub-Overseer's work in this Division from 16th April 1940 for one year.

II. Other Agricultural Schools.

(i) Agricultural Classes attached to High Schools.

During the year under report new agricultural classes beginning with standard IV were attached to the two High Schools of Satara and Bijapur with a view to impart agricultural education to the students. These schools were inspected by the Deputy Director of Agriculture, S. D., in March 1940 in company with the Educational Inspectors, C. D., and S. D., and necessary advice in connection with the improvement in theory and practice was given. The Annual Examination papers of these classes in Agricultural subjects were also drawn by the Deputy Director.

(ii) Agricultural Bias Classes.

There are about 58 Agricultural Bias classes in this Division under the control of the District Local Boards. Cropping schemes and Budget Estimates for 1940–41 for 10 Bias classes, 2 in Ratnagiri and 8 in Bijapur Districts, were received from the Administrative Officers concerned for scrutiny and approval. These were checked and sanctioned.

III. Literacy Campaign.

According to the policy of Government to make all the persons of educational age on the Government institutions literate, work in teaching about 15 illiterate servants was undertaken with enthusiasm on all the Agricultural Institutions in this Division and the progress made so far in this connection is satisfactory and promising. The servants have taken a liking to learn and are able to read and write ordinarily.

F. OTHER ACTIVITIES OF PUBLIC INTEREST.

(1) The Deputy Director of Agriculture, S. D., is a member on the Fodder and Grazing Committees for the Districts of Poona, Dharwar and Kanara. He attended the quarterly meetings of these Committees held at Poona during March and June 1940, at Dharwar in January 1940 and at Karwar in May 1940 and took part in deliberations and advised.

(2) He is also a member of the District Rural Development Board, Belgaum, and attended its meetings held at Belgaum in November 1939 and February 1940 and gave advice on various agricultural subjects. He had also to work as a member of the Sub-Committees appointed by the Board in connection with (1) the retention of Bankapur Cattle Farm and (2) enquiry into fixing of the rates of cotton ginning and pressing factories.

(3) References were received from the Collector of Kanara in connection with the controversies about the spraying of Bordeaux Mixture against Koleroga on Betelnuts. To investigate this, the Deputy Director of Agriculture with the Director of Agriculture and the Plant Pathologist to Government accompanied by the Revenue officers and the Inspector of Rural Development, Karwar, visited several gardens in Sirsi, Siddapur and Honavar. In the enquiry it was confirmed that the spraying of Bordeaux Mixture against Koleroga was so far the most effective and economical method of treatment and the complaints as to its adverse effects were not sufficiently substantiated.

(4) Demonstrations on a big scale for controlling the hoppers and mildews on mangoes were, in collaboration with the Plant Pathologist to Government, held at Dharwar, Belgaum and Vengurla in February 1940. At these demonstrations, the remedial measures were actually shown to a large number of mango gardeners with great success.

(5) Enquiries for starting (1) a Better Farming Society at Konnur in Gokak Taluka of Belgaum District, (2) Co-operative Sugar Factory Scheme at Tambwe in Satara District and (3) Rice Breeding Station at Vadgaon (district Poona) were received for Deputy Director's opinion. Accordingly, these stations were visited in company of the officers concerned and the necessary advice was given. Similarly, remarks were offered on the question of Minor Irrigation Schemes in Belgaum and Kanara Districts received from the Executive Engineers of those districts.

(6) The Honourable Sir Gilbert Wiles, Chief Adviser to the Governor of Bombay, visited Dharwar in December 1939, and the Honourable Mr. H. F. Knight, Adviser to the Governor of Bombay, visited this Division in March 1940 and the Deputy Director accompanied him and showed the working of the Kannad Agricultural School at Devihosur, Bankapur Cattle Farm and of the Agricultural Farms at Dharwar and Kumta. The Honourable Mr. Knight was highly pleased with the working of these institutions and particularly of the Devihosur Agricultural School and the Cotton Breeding Section on the Dharwar Farm.

(7) The Deputy Director of Agriculture, after considerable search, located a cheaper and more suitable site at Soundalga, taluka Nipani, district Belgaum, for the Tobacco Breeding Station, in the Southern Division. The site selected has been finally approved by the Director of Agriculture and the question of acquisition of this site is now under consideration and final sanction by Government. Similarly, the question of acquisition of the land for the Kumta Farm was engaging the attention of the Deputy Director and proposals in this connection have also been submitted to Government for consideration.

(8) Preliminary enquiries in connection with the starting of training of Village Assistants, one at Manjri for Maharashtra and the other at Devihosur for Karnatak, have been completed and the necessary proposals have been submitted to Government for consideration and sanction.

(9) Enquiries as usual were received from the public on various technical questions pertaining to improvements in agriculture and these were promptly attended to.

(10) During the year under report there were no cases of corruption in the staff in this Division and greatest vigilance was exercised in this respect.

H. G. BALUCH,
Deputy Director of Agriculture,
Southern Division, Dharwar.

Dharwar, 13th August 1940.

1940-41 Programme of work under the Deputy Director of Agriculture, Southern Division, Dharwar.

COTTON BREEDER'S SECTION, DHARWAR FARM.

A. COTTON.

(*a*) KUMPTA.

(1) Trial of selected strains against local kumpta.

(2) Selections in the following crosses :—

(*i*) [1A–14–3 (= D1 × Rosea) × (D1 × D2 =) 1–0–1] F8.

(*ii*) [(Jay × N14) × (D1 × Rosea =) 1A–14–3] F7.

(*iii*) [(K.F.T. 12–2–5) × New Jayawant] F4.

(*iv*) [(K.F.T. 12–2–5) × (D1 × Rosea =) A1–14–3] F3.

(3) Back-crossing :—

(*i*) New Jayawant × B.D. 8 back-cross F6–1–6.

(F1 to be back-crossed with New Jayawant).

(*ii*) (K.F. T12–2–5) × B.D. 8 back-cross F6–1–6.

(F1 to be crossed with New Jayawant).

(*iii*) (K.F. T12–2–5) × (D1 × Rosea =) 1A–14–3.

(F1 to be back-crossed with 1A–14–3).

(4) Cotton Wilt :—

(*i*) Behaviour of wilt resistant cottons in the field.

(*ii*) Behaviour of the individuals selected from the transplanted plants of F3 generation of the cross (New Jayawant × K.F. T12–2–5) and of certain selections made.

(*b*) AMERICAN COTTONS.

(1) Trial of the promising segregates of the cross between Gadag No. 1 × CO II for yield.

(2) Trial of interspecific crosses from Surat.

(3) Back-crossing :—

G1 × CO II 9–7–6–6 × G. peruvianum.

(F1 to be back-crossed with 9–7–6–6).

B. GROUNDNUT.

(1) Maintaining Valencia, Tennessee white, Virginia erect, Strain 5, Spanish Improved and Pondicherry 8 pure for seed distribution.

C. JOWAR.

(1) Maintaining the selected strains pure.

D. GRAM-WILT.

(1) Study of the incidence of wilt mortality in strain 18-12, Niphad, strain, 816, Dohad, Deccan 58, Pusa 53 and Nagpur 352.

(2) Trial of local varieties of gram, brought from Sind, U.P., and Punjab for wilt-resistance.

(3) Pot-test of strain 18–12 under green-house condition.

E. TUR-WILT.

(1) Preparing wilt compost for establishing a highly infected wilt-plot both at Arbhavi and Dharwar Farm.

DHARWAR FARM.

A. COTTON.

I. *Varietal Trials.*—Trials of New Jayawant, Early Jayawant and Jayawant against Kumpta.

II. *Manurial Trials*—(*a*) F.Y.M. series ;—

(*i*) F.Y.M. 2½ tons per acre every year.

(*ii*) F.Y.M. 2½ tons per acre every second year.

(*iii*) F.Y.M. 2½ tons per acre to Jowar rotation crop.

(*iv*) No manure at all.

(*b*) *Sann Green manure series :—*

(*i*) Sann alone. (*ii*) Sann *plus* 1,500 lbs. F.Y.M. per acre. (*iii*) F.Y.M. alone 2½ tons per acre. (*iv*) No manure.

III. *Cultural Series.*—(*i*) Ploughing every year, (*ii*) ploughing once in two years, (*iii*) ploughing once in three years, (*iv*) no ploughing but harrowing only.

IV. *Dibbling* vs. *drilling cotton.*—(*i*) Dibbling 3′ apart between rows and 9″ between plants. (*ii*) Drilling according to local method.

B. JOWAR.

I. *Manurial Series.*—(*i*) F.Y.M. 2½ tons per acre every year. (*ii*) F.Y.M. 2½ tons every second year. (*iii*) F.Y.M. to the rotation crop cotton. (*iv*) No manure at all.

II. *Cultural series.*—Ploughing once a year ; once in two years and once in three years against no ploughing but harrowing.

III. Seed-rate (3 *vs.* 4 lbs.) and spacing experiments (15″ *vs.* 18″ between rows).

C. GROUNDNUT.

I. *Varietal trials.*—(*a*) Spanish Pea-nut strain No. 5, Spanish Pea-nut Improved and Valencia.

(*b*) Trials of Coimbatore varieties against Pondicherry No. 8.

II. *Spacing experiments* :—

(*a*) 6″ × 4″ dibbling.

(*b*) 6″ × 9″ dibbling.

(*c*) 12″ × 9″ dibbling.

D. WHEAT.

I. *Varietal trials.*—Bansipalli 808 ; strain 103 and Pusa strains against local red hard wheat.

II. *Sann green manure series.*—(*i*) Sann alone, (*ii*) sann *plus* F.Y.M. 1,500 lbs. per acre, (*iii*) F.Y.M. alone 2½ tons per acre, (*iv*) no manure at all.

III. Clean cultivations *vs.* cover crops to wheat.

E. GENERAL.

I. Varietal trials of Mug, gram and chillies.

II. Trial of Lucerne, Napier grass and Barseem as dry crop.

III. Seed multiplication of Jayawant cotton and wilt immune sann.

ARBHAVI FARM.

A. SUGARCANE.

I. (1) Varietal trials of CO. Nos. 419, 421, 413 and 414 in comparison with J. 213.

(2) Study of the varieties CO. Nos. 360, 421, 417, 428 and E.K. 28.

(3) Seed-multiplication of the varieties CO. 419, E.K. 28 and P.O.J. 2878.

II. *Rotational Experiments.*—(*a*) Sann alone as green manure followed by sugarcane. (*b*) Maize and sann mixture followed by sugarcane.

(2) Two-year rotational :—(*a*) first set (*i*) sann green manure followed by early planting of maize in the 1st year, (*ii*) sann green manure followed by sugarcane in the 2nd year, (*b*) second set (*i*) cotton and maize mixture in the 1st year, (*ii*) sann green manure followed by sugarcane in the 2nd year.

III. *Manurial experiments :—*

(1) 1st set ; Bulky basic manures—

(*a*) 25 cartloads of F.Y.M. in one lot at the time of getting land ready for sugarcane.

(*b*) Sann green manure alone.

(*c*) Sann green manure *plus* 5 carts of F.Y.M. per acre to be applied to sann before sowing.

(*d*) Sann green manure *plus* 5 carts of F.Y.M. per acre to be applied at the time of burying sann.

Top-dressing of 75 lbs. N in the form of Sulphate of Ammonia and groundnut cake in three doses as per scheme.

(2) 2nd set : Bulky basic manures—

(*a*) 25 carts of F.Y.M. to be given at the following doses :

(*i*) 10 carts to the Sann and maize mixture.

(*ii*) 15 carts while getting the land ready for sugarcane.

(*b*) *Top-dressing.*—(*i*) 75 lbs. of N, (*ii*) 100 lbs. of N. as per scheme.

IV. *Cultural experiments.*—Spacing 3 and 3½ feet apart between rows.

B. COTTON.

V. Varietal trials of CO_2 and segregate of (GI × CO_2).

C. TUR.

VI. Tur wilt work : As per programme laid out by the Plant Pathologist.

D. MAIZE.

VII. Isolation of high yielding strains.

E. MISCELLANEOUS.

VIII. Cultivation of Napier grass ; service nursery in regard to fruit crops and compost-making.

MUGAD RICE BREEDING STATION.

A. RICE.

I. *Yield trials of the following.—*

(1) Dodagya selections (New lot) Nos. 79–4, 106–6, 89–6, 97–1 and 137–5 against D. 6–2–2.

(2) Dodagya selections (old lot) Nos. 5–2–2, 6–2–2 and 6–2–3 against local.

Strain Nos. 6–2–2 and 6–2–3 to be tried in the cultivator's fields at Hangal, Belgaum and Chandgad.

(3) *Selections in fine rices :—*

(*a*) Early strains : Nos. 26-2 and waner-1 against local, and M. 161.

(*b*) Mid-late strains : Nos. 3-3, 52-1 and 52-2 against local and M. 81.

(*c*) Late strains : Nos. 27-4, 27-6, 44-1, 47-3 against local and M. 161.

(*d*) Very late strains : Nos. 9-1, 11-1, 11-3, 21-1, sanna-bhatta 5 and *yeli khirsal* 4 against local and *Indrasal.*

(4) Antersal late : A. 267 and A. 176 against A. 200.

II. *Hybridization.*—Study of F1 and F2 of the crosses.

III. The continuance of the seed-multiplication of important varieties and their maintenance in pure form.

B. RAGI.

IV. Isolation of desirable strains in Ragi.

KUMTA FARM.

A. RICE.

I. Yield trials of (1) Rangoon and Tavakavam varieties, (2) Muginbeldu strains against local.

II. Study of the upghat *white Halga* strain Nos. 1690 and 1681.

III. Isolation of the desirable strains in the varieties of Karwar-Ankola rice zone and Chintamani and coastal *Bile Halga* varieties.

IV. Seed-multiplication of strain Nos. 1315, 1061, 244, 1690 and 1681.

B. SUGARCANE.

Yield trials of CO. 402, 413 and 419 with H.M. 320.

C. GENERAL.

Varietal trials of *Pine apple,* dry cultivation of *Kew* variety, varietal trials of *tapioca* and economics of *cashewnut* plantation and Tung oil trees will be continued.

KOPARGAON FARM.

A. SUGARCANE.

I. (*i*) *Water-cum-manure experiment.*—

Water quantities.	Intervals.	Manures.	Varieties.
95″	10 days in summer	.. 225 lbs. N.	POJ. 2878
115″	Do.	.. 300 lbs. N.	CO. 419
130″	Do.	.. 375 lbs. N.	

(*ii*) *Manuring.*—

Basal sann green manuring to be grown "in situ" in June and ploughed in August or September. Ratio of S/A to cake in top-dressing 1 : 1. Distribution. Planting to be done by mid-January.

II. *Varietal trials.*—Combined plantings.

July	POJ 2878 (control).
October	CO. 419
January	CO. 426

Manuring.	Basal.	Top-dressing.
July	.. 20,000 lbs. compost or Farm yard manure.	375 lbs. N.
October	.. Do.	.. 300 lbs. N.
January	.. Do.	.. 300 lbs. N.

Proportion of sulphate to cake in the proportion of 1 : 2.

III. *Manurial experiments.*—

Basal manures.	Top-dressing.	Variety.
	Cake alone	
Compost	S/A & Cake—1 : 1 N.	CO. 419
No compost	S/A & Cake—1 : 2 N.	
	S/A & Cake—2 : 1 N.	

Manuring.

Basal dose of 20,000 lbs. of compost or farm yard manure in one series. Top-dressing 300 lbs. N. Planting to be done by mid-January.

IV. *Rotational series.*—

(*i*) Rotational crops:—(1) Cotton, (2) Bajri, (3) Groundnut (4) Sann, (5) Patada Shevra, (6) Fallow.

(*ii*) Variety of cane to be grown on the whole area-CO. 419. No of replications—4. Complete randomisation.

(*iii*) *Manuring.*—After rotational crops, and before planting of cane, 20,000 lbs. of farm yard manure per acre to be added. Top-dressing for cane 225 lbs. N., half as S/A and half as cake.

Planting to be done by the end of January.

B. JOWAR.

I. Yield trial of strain M. 47-3 with local.

II. Green manure for Rabi Jowar—

(*i*) Sann, (*ii*) Ran-matki, (*iii*) Patada Shevra.

C. COTTON.

I. Varietal trials of Banilla and Jarila.

D. GROUNDNUT.

Trial of groundnut varieties from Coimbatore.

RATNAGIRI FARM.

I. The maintenance of the purity and seed multiplication of improved rice and nagli strains.

II. Village trials of rice strains-Varangal No. 487 and fine Waksal No. 1.

III. Study of the yields of Mosambi, Santra and guavas.

IV. Early and annual bearing of mango plants.

MOHOL FARM.

I. Isolation of sub-cultures from strain No. 35-1 for characters of high yield and earliness.

II. Further selection work in Dagadi strains.

III. Yield trials of Maldandi strain Nos. 35-1, 47-3 and M-9 with local.

IV. Village trials of Maldandi strain Nos. 35-1 and 47-3 in Sholapur and Bijapur districts.

(Signed) H. G. BALUCH,
Deputy Director of Agriculture, S. D., Dharwar.

Dharwar, 13th/15th August 1940.

APPENDIX B.

Summary of the work done under the Deputy Director of Agriculture, Northern Division, for the year 1939-40.

I. *Staff.*

I took charge of the post of the Deputy Director of Agriculture, Northern Division, Surat, on 16th September 1939 and held it till the end of the year. Mr. H. G. Baluch was in charge of this post till 15th September 1939.

Mr. A. K. Shah continued to act as Cotton Breeder, South Gujarat, Surat, till 10th October 1939 when he was transferred to Viramgam as Cotton Breeder, North Gujarat, and Mr. G. B. Patel was transferred to Surat as Cotton Breeder, South Gujarat.

One unfortunate event of the year was that Mr. A. K. Shah died on 20th March 1940 with a sudden illness. He was a very promising young officer and his premature demise was a great loss to the Department in this Division.

Mr. M. L. Patel, Crop Botanist to Government, Bombay, Karjat, joined his duties (after leave) as Cotton Breeder, North Gujarat, on 16th May 1940 and the charge during the intervening period was held by me. There were no other major changes in the Division.

Owing to the reorganisation of the Agricultural and Co-operative Departments, Gujarat and North Central Divisions were amalgamated from 15th April 1939 with continuance of Surat as Headquarters and the Deputy Director of Agriculture, Gujarat, has been designated as Deputy Director of Agriculture, Northern Division, Surat. This combined Division now comprises of 10 districts (4 of Gujarat, 3 of Deccan and 3 of Konkan including Bombay Suburban) and has 7 experimental stations and one Agricultural School under its administrative control. The District propaganda staff of the Agricultural Department was transferred to the control of the Registrar, Co-operative Societies, with the creation of a new Department called the Rural Development Department and the Deputy Director of Agriculture is now required to attend mainly to research, experiments and education. The work done during the year is therefore summarised under the two heads :—

I. Research and experiments.

II. Agricultural education.

II. *Season.*

The agricultural season for 1939-40 in Gujarat was characterized by low rainfall and a rainfall of short duration. The regular monsoon season started late (July) and ended early (September) with a long break in the middle. Most of the kharif crops were sown in July when fairly good rains were received. The germination of these crops was good and the cultivators cherished good hopes for a bright season. A long

break however occurred for a month and all young crops except cotton in black soil showed signs of withering. The second and third weeks of August were very gloomy and indicated signs of a famine. There were good rains however in the last week of August and they saved almost all kharif crops from withering. They began to revive in September but the low rainfall in that month and consequently the want of moisture again affected crops. There were practically no rains in October and yields of almost all kharif crops were low. The yields of kharif jowar were 60 to 75 per cent. normal in Surat District whereas only 30 to 60 per cent. in other districts. Bajri which is mainly grown in Ahmedabad and Kaira Districts suffered more and its yields were only 30 to 40 per cent. normal. In some places especially of Kaira District the premature crop had to be harvested for fodder. The rice crop suffered most and altogether failed in many places. Its yields ranged widely from 10 to 60 per cent. normal but were very poor in general. Inferior millets and pulses shared fate with jowar and bajri. The other kharif crops like maize and groundnut also suffered from want of rains and gave yields below normal. The cotton crop suffered from want of rains in October but was revived to a great extent by continued good cold weather in November and afterwards, and in fact beyond expectation especially in the retentive black soil. The yields of cotton were 70 to 90 per cent. normal in Surat and parts of Broach District whereas 40 to 70 per cent. normal in the northern parts of the Division. The rabi crops wheat and jowar suffered from want of moisture in the soil and produced yields ranging from 40 to 70 per cent. normal. The growth of grass was poor in all places except in the southern parts of Surat District. The scarcity of fodder was keenly felt especially in Ahmedabad and Kaira Districts where almost all food and fodder crops fared badly and the quantity of grass was very limited.

The season for North Konkan was characterized by scanty rainfall. The monsoon started late and transplanting of rice which is the main crop of the tract could not be done in time. It was done partly in July and partly in August. Both early and late varieties of paddy suffered from want of water. The early varieties suffered from want of rains in the latter half of July and first half of August whereas the late ones from want of further rains in September and October. The coastal belt of North Thana District suffered more than others. Owing to want of water in rice fields the growth of grass and other weeds was more than usual. There were no pests and diseases. The yields of paddy ranged from 40 to 70 per cent. normal. The other important crop grown in this tract is Nagli which fared slightly better than paddy. There were some rains in the months of November and December in this tract and the second crops like wal, udid and tur got some benefit from the same. The growth of grass was good and the supply of fodder was adequate in this tract.

The season for North Central Division was characterized by inadequate rainfall on the whole. The monsoon started rather late and sowing of Kharif crops was delayed by about a fortnight in many places. There

were good rains in early July and the germination of kharif crops sown at this time was satisfactory. There was a long break in the latter half of July and first half of August and kharif crops especially on light soils suffered from want of moisture. There were good rains however in the last week of August which helped all kharif crops. September and October rains were again scanty and they affected the yields which could otherwise have been normal. The yields of kharif jowar ranged from 60 to 85 per cent. normal whereas those of bajri, groundnut and pulses from 50 to 75 per cent. normal. The cotton crop thrived well in the black soil of the Tapti valley but suffered from want of moisture in the lighter soils elsewhere in the Division. The yields ranged from 60 to 90 per cent. normal in light to deep black soils. There were some late rains in the months of November and December in North Central Division and they were beneficial to the rabi crops. Wheat in the black soil of the Tapti valley thrived well and produced yields ranging from 75 to 90 per cent. normal. In lighter soils there was deficiency of moisture for the full growth of wheat and rabi jowar and the yields ranged from 60 to 75 per cent. normal. Grape-vine which is the main garden crop in the Nasik District had Downy Mildew which was controlled by dusting. There was no frost and its yield was normal. The cultivators got good returns from their grape-vine gardens during the season.

The season on the whole for the Northern Division of the Bombay Province was not satisfactory and the yields of most crops were below normal. The prices of the farm produce especially of cotton ruled high in the market and the cultivators got the benefit of the same. Owing to low yields, however, the economic position of the cultivators has not materially improved.

III. RESEARCH AND EXPERIMENTAL WORK.

Crop Breeding at Surat.

Cotton.

Isolation of type or types equal to 1 A.L.B. in seed cotton yield and ginning percentage and 1027 A.L.F. in staple qualities continued to be the main object.

Selections.—18 progeny rows of S-9-1-4 were grown. Of these four, having ginning percentage 37·9 to 38·7 against 36·5 of 1027 A.L.F., are selected. They are nearly equal to 1027 A.L.F. in fibre length. Similarly two cultures from S-5 are selected for higher ginning percentage (37·8 to 38·3 per cent.). Out of the 17 selections of 1938–39, three viz., S-44, S-45 and S-47 having ginning percentage from 38·1 to 38·6 and fibre length 23·8 to 24·3 mm. are retained. None of the 12 collections made from the farm crop in 1938-39 showed the desired combination of economic characters and hence they are rejected. The examination of the crop in Olpad and Ankleshwar locality did not give better material than what is available from the crosses of 1 A.L.B., 1027 A.L.F. and B.D. 8. An intensive study by further selection was done from the pure lines of 1027 A.L.F., Seg. 8-1 and 1 A.L.B. The number of progenies grown from individual selected plants was 25 in 1027 A.L.F., 15 in Seg. 8-1 and

10 in 1 A.L.B. The range of variation in ginning percentage between progenies was 35·9 to 37·4 in 1027 A.L.F., 38·1 to 40·1 in Seg. 8-1 and 39·9 to 41·1 in 1 A.L.B. There was no appreciable difference in fibre length. Three progenies in each have been selected for further study.

Crosses and Backcrosses.

A. (1) *Segregate* 22-3-2-8.—The ginning percentage in this segregate is lower than 1027 A.L.F. by one per cent. but the staple is longer and finer. Eight individual plants are selected for further trial with ginning percentage ranging from 36·6 to 38·8 and fibre length from 25·0 to 27·2 mm.

(2) *Segregate* 8-1 × 1027 *A.L.F. F*-5.—17 progenies were grown. Five are retained for further study. They have ginning percentage ranging from 38·6 to 39·6 and fibre length from 24·2 to 25·3 mm. with feel comparatively better than Segregate 8-1.

(3) *Segregate* 8-3 × 1027 *A.L.F. F*-6.—Out of eight cultures grown, one is retained with ginning percentage=39·5 and fibre length, 24·8 mm.

(4) (*B.D.* 8 × 1 *A.L.B.*) *F*-1 × 1027 *A.L.F. F*-6.—25 progenies were grown. One with ginning percentage 38·7 and fibre length=24·5 mm. is continued further.

(5) (1027 *A.L.F.* × *Gaorani* 6) *F*-1 × 1027 *A.L.F. F*-1 × 1027 *A.L.F. F*-3.—Three cultures were grown. The ginning percentage was very low—30·4 to 34·7. Three plants are selected (one from each) particularly for fibre length—26·6 to 27·4 mm.

B. F-1 generation of the following crosses was grown :—(1) 1027 A.L.F. × B.C. 1-6, (2) Seg. 8-1 × B.C. 1-6, (3) Seg. 22-3-2-8 × B.C. 1-6. B.C. 1-6 is a segregate of (B.D. 8 × G.A. 26) F-1 × B.D. 8 cross obtained from Broach. The high ginning of B.C. 1-6 (42 per cent.) was partially dominant. The staple was slightly longer than the mean of the parents. The F-2 generation together with the backcross 1027 × (1027 × B.C. 1-6) F-1 and the composite cross 1027 × (Seg. 8-1 × B.C. 1-6) F-1 will be grown next year.

Comparative variety trials of 1027 *A.L.F., Seg.* 8-1, 1 *A.L.B. and S.* 9-1-4.—These were grown in 8 replications, i.e., in two latin squares of 4 replications each. The plot size was 80′ × 20′=1·47 gunthas. The results are :—

Types.	Yield of seed cotton per acre (lbs.)	Ginning percentage.	Fibre length inches.	Fibre weight 10–7 oz.	Maturity percentage.	Local valuation on Broach.
						Rs.
1027 A.L.F. ..	391	36·6	0·99	0·204	68/12	55
Seg. 8-1 ..	449	39·1	0·93	0·209	70/14	37
1 A.L.B. ..	481	40·2	0·87	0·211	72/13	25
S. 9-1-4 ..	377	37·1	0·96	0·206	53/26	40
Difference to be significant. P = ·05 ..	30					

For seed-cotton yield, 1 A.L.B. is significantly superior to Seg. 8-1, 1027 A.L.F. and S. 9-1-4. Segregate 8-1 is significantly superior to 1027 A.L.F. and S. 9-1-4, while the difference between the latter two is not significant. Seg. 8-1 is slightly later than 1027 A.L.F. (by about 5 days) while S. 9-1-4 is distinctly earlier (by about two weeks). The ginning percentage of S. 9-1-4 is only slightly higher (by 0·5 per cent.) than that of 1027 A.L.F. It remains to be seen if this can be improved upon by selection. Further, S. 9-1-4 has comparatively lower fibre maturity.

Three year's trial of 1027 A.L.F., Seg. 8-1 and 1 A.L.B. shows that on an average, for seed cotton yield, Seg. 8-1 is higher than 1027 A.L.F. by 9 per cent. but lower than 1 A.L.B. by 7 per cent. It gins higher than 1027 A.L.F. by nearly 3 per cent. but lower than 1 A.L.B. by 1 per cent. Thus it yields 18 per cent. more lint than 1027 A.L.F. but 10 per cent. less than 1 A.L.B. For fibre length Seg. 8-1 is very nearly equal to 1027 A.L.F. but is slightly coarser. It is distinctly superior to 1 A.L.B. for these characters. In spinning value it is equal to 1027 A.L.F. for two years but lower in one year. The spinning test results of 1939-40 are yet awaited. On an average, it is valued more than 1 A.L.B. by Rs.15 per candy but less than 1027 A.L.F. by Rs. 10.

The three varieties were tried on tenants' area on the Surat Farm. There were three trials in duplicate plots of 10 gunthas under each variety. On an average, Seg. 8-1 and 1 A.L.B. gave respectively 4 per cent. and 10 per cent. more seed-cotton yield than 1027 A.L.F. The difference in ginning percentage as described above were maintained. The lint from these trials has been sent for mill tests. It is proposed to test these three varieties out in the district in cultivators' fields during the coming season.

Production of selfed seed.—The selfed seed produced was 1027 A.L.F.—385 lbs.; Seg. 8-1—166 lbs.; 1 A.L.B.—160 lbs. and B.D. 8—60 lbs.

Maintenance of types.—Thirty types were maintained pure by selfing. Of these, Bani has been dropped and Herbeceum Spotless (Ghost-spot-like), Seg. 8-1 and B.C. 1-6 added making in all 32 types to be maintained.

Sowing of cotton with "Wal" for economizing selfed seed.—Two and three cotton seeds with (2 wal seeds) and without wal seeds were sown per dibble. As the conditions for germination were favourable the advantage of using "Wal" seed was not brought out. The experiment will be repeated.

Jowar.

Maintenance of types.—Twenty types were maintained pure by selfing.

Production of selfed seed of Budh Perio 53.—18 lbs. of selfed seed of B.P. 53 was produced for further multiplication.

Interspecific Hybridization in cotton.—This research scheme is financed by the Indian Central Cotton Committee at a cost of Rs. 14,014 spread over a period of five years commencing from 1st November 1938. Large scale crossing work done at Surat has in all given 40 first generation hybrids between New World and Old World cottons. These are very vigorous but are self-sterile. Backcrossing to New World cottons has given 51 first backcross plants of which 40 are more or less fertile. From the F-2 and F-3 generations of a few promising ones of these, selections with desirable characters are being made. The use of the alkaloid colchicine has been successfully done for inducing fertility by chromosome doubling in the sterile F-1 hybrids referred to above. The affected plants produced quite a good number of bolls though the number of seeds per boll was comparatively less. Similarly double diploids of Asiatic cottons are created by treating F-1 hybrids of different Asiatic species. This opens out a wide field for further research in cotton both from economic and academic points of view. The Indian Central Cotton Committee has further sanctioned the expansion of the scheme at an additional cost of Rs. 26,495 thus providing for increase in staff and funds for breeding and cytological research.

CROP BREEDING AT BROACH.

Cotton.

This is the 8th season of the cotton work financed by the Indian Central Cotton Committee. The main object is to evolve a highly wilt resistant (no mortality nor partial wilting of plants) high ginning (40 per cent.) high spinning (30's) and good yielding strain of cotton to replace the highly wilt susceptible, low spinning (15's) but high ginning (40 per cent.) Goghari cotton grown on an area of about 8 lakh acres in the Narbudda-Mahi zone.

Crosses.—Selection was continued in crosses and backcrosses. During the year under report, 11 segregates were under replication trials, 7 from the original lot of 14 of 1937–38 and 4 new ones—two from (B.D. 8 × G.A. 26) × B.D. 8, one from (B.D. 8 × S-7-1) and one from B.D. 8 × (B.D. 8 × S-12-1), together with checks B.D. 8 and Local. The results of this year as well as those of the previous two seasons (except those of 4 which were put to replication trials for the first time in 1939–40) clearly demonstrate that the segregates are now stable as they have been maintaining their respective values of high ginning, outturn, high spinning qualities and high resistance to wilt disease.

The following statement gives the average results of three years :—

Segregates and Checks.	Ginning out-turn.	Fibre length.	Spinning value highest standard warp counts.	Yield of seed cotton per acre.	Yie of lint per acre.	Resistant or susceptible to wilt disease.
	Per cent.	Inches.		Lbs.	Lbs.	
B.D. 8 ..	34·0	0·90	40	567	193	Highly resistant *i.e.* no mortality and partial wilting but root discoloration.
Local ..	40·2	0·76	14	585	235	Highly susceptible (i.e. good deal of mortality, partial wilting and root discoloration.)
(B.D. 8 × G.A. 26) F9—						
76–1 ..	41·0	0·87	39	572	236	Highly resistant like B.D. 8.
76–12 ..	40·3	0·88	39	545	220	Do.
(B.D. 8 × G.A. 26) × B.D. 8 F7—						
1–2 ..	40·5	0·89	39	571	231	Do.
1–6 ..	41·8	0·88	39	592	247	Do.
5–18 ..	43·1	0·86	38	550	237	Do.
6–20 ..	40·7	0·88	38	529	216	Do.
6–25 ..	39·7	0·91	35	546	215	Do.

Ginning outturn.—Taking the average ginning of the local cotton as the standard, about all the segregates are as high in ginning as the local. Segregates 1-6 and 5-18 are definitely superior to the local.

Fibre properties.—The average fibre length and spinning value of all segregates are nearly equal to those of B.D. 8 but considerably more than those of local.

Wilt.—Absence of any mortality or partial wilting even when grown in a thoroughly wilt infected special plot definitely indicates that all these segregates are as resistant as the resistant parent B.D. 8.

Yield of seed cotton.—Segregate 1-6 has given appreciably more yield than the local; and 76-1 and 1-2 slightly more than B.D. 8. The remaining 4 have yielded less than B.D. 8. When yields of previous two years are considered it is found that most of the segregates have shown better performance than the local and B.D. 8. The very high yield of the local during the current year is rather unusual.

Yield of lint.—Lint is the most important salable produce in cotton and its yield per acre is therefore more important than seed-cotton in deciding the yielding capacity of a cotton strain. In this the segregate 1-6 has shown the best performance and 5-18, 76-1 and 1-2 nearly equal to the local. The rest are slightly poorer than the local and B.D. 8 is the poorest of all.

Order of merits.—Taking all the important characters viz. ginning outturn, fibre length, spinning value and yields of seed-cotton and lint, together the order of combined merits of these 7 segregates and two checks is—1-6, 76-1, 1-2, 5-18, 76-12, 6-20, B.D. 8, local and 6-25. Segregates 1-6, 76-1 and 1-2 are worth testing in the district in cultivators' fields and arrangements have been made for the same.

In addition to these segregates under replication trials, 11 other segregates, 6 from (B.D. 8 × G.A. 26) F9 and 5 from (B.D. 8 × G.A.26) × B.D. 8) F7 with fairly good combination of ginning fibre length and wilt resistance are also being maintained as second best lot by raising single plant rows of the best selected plants from them. The number of other pure types of cotton maintained by selfing for various purposes is sixteen.

Seed-multiplication.—The highly wilt resistant and high spinning strain B.D. 8, which is being spread in the Broach District since 1935-36 was sown on one acre this year and 326 lbs. selfed and 555 lbs. open fertilised seed was produced and supplied to the Cotton Superintendent for further multiplication in the District.

Crop Breeding at Viramgam.

Cotton.

The cotton breeding work here at Viramgam is partly financed by the Indian Central Cotton Committee, Bombay since 1937 and it has therefore been possible to intensify the breeding work on this crop. The object is to improve the Dholleras-wagad cotton (*a*) for yield and quality and (*b*) for earliness to escape frost. The season was extremely dry the total rainfall being 10·98 inches. The effective season started very late by the end of August and lasted only for 12 days with a fall of 7·56 inches. Most of the work had to be done therefore by growing cottons under irrigation in a special plot taken on lease for the purpose.

Variety trials.—Local Wagad, Wagad 8 and Seg. 4-1 were compared in 8 ramdomized replications. The table below shows the average performance :—

Average results per acre (1933–34 to 1939–40).

Variety.	Yield of seed cotton.	Yield of lint in.	G. P. per cent. of lint.	Fibre length inches. (1933–34 to 1938–39).	Spinning value. H. S. W. C.
	Lbs.	Lbs.			
Wagad 8	524	205	39·2	0·80	13·5
Seg. 4–1	485	206	42·5	0·79	17·5
Local Wagad ..	470	165	35·1	0·81	16

The experiment this season does not show significant difference. Seg. 4-1 is distinctly superior in ginning to local Wagad by 7 per cent. and to Wagad 8 by 3·3 per cent. The lint yields of Wagad 8 and Seg. 4-1 are equal. Wagad 8 is slightly inferior to local Wagad in spinning value whereas Seg. 4-1 is slightly superior to it. It is proposed to test these cottons out in the district in cultivators' fields.

Selections.—With a view to improve the quality of Wagad cotton. selection was continued in 17 families mentioned in the last year's report and 14 families are retained. The selections 115, 126 and N. 89-2 are promising and will be replicated on a small scale. The last one viz. N. 89-2 will also be tested along with Seg. 4-1 in varietal trial. None of the 31 individual selections of 18 families was promising and hence rejected. Six families from the Cotton Botanist, Vondh (Cutch) were grown with Wagad 8 as check. Only two progeny rows from one family C-42 are retained for further selection. F.S. 401 of 1938–39 was found promising for high yield combined with fairly good other characters and has been retained. Fresh selection was done from 5 bulk samples of Wagad cotton received from the Cotton Botanist, Cutch and 31 individual plants with ginning percentage ranging from 36 to 43 and staple length from 19 to 22 mm. are kept for further selection.

Crosses.—The selection was continued in the crosses (W-26 × 1027 A.L.F.) F6 and (Seg. 4-1 × B.D. 8) F5. Out of the former H.S. B-1 is promising and will be tested in the varietal trial. The cross W-8 × B.D. 8-12-1 was found to be late and low yielder and is only maintained. Selection in the crosses (stiraght and back) with 22-3-1-3 was continued. The selections are good for staple and ginning percentage but earliness is not found.

The crosses of Wagad types with Russian, Perisan and Early Herbaceums.—From the cross with Russian cotton particularly with R-25 earliness is met with. Selections have also good staple length. None of the selected plants from the Persian crosses showed the staple length of the Persian parents but it goes to about 22 mm. with good feel. In the crosses of East Iran the boll opening was wide and hence only three plants are selected. In the composite crosses with Early Herbaceum, selection was continued.

Jowar.

No work could be carried out owing to dry season.

CROP BREEDING WORK AT JALGAON.

Cotton.

This is the third year of the extension scheme started for the improvement of Khandesh cotton and which is to run for a total period of 5 years. It is partly financed by the Indian Central Cotton Committee, Bombay.

Selections.—The 120 plant selections of Dokras cotton from Chandur mentioned in the last year's report were increased to 121 at the time of sowing. Half the number of seeds of each plant was sown in the breeding area for study of economic and botanical characters and the other half in wilt infected plots to know the wilt incidence. The plants meant for the study of economic and agricultural characters were grown in three rod-row cultures each row being sown with 25 seeds. Every fifth row in a rod-row series was that of Jarila serving has control. As a result of the field and laboratory examination, 54 lines (out of 121) have done well but 23 are found to be better than others. They are superior to Jarila in ginning percentage, majority of them giving 3 to 7 per cent. more than Jarila and in point of staple length and earliness they are as good as Jarila. Their yield comparison will be better understood next year. This year out of 23 best selections, 8 have yielded more than Jarilla and 2 are equal to it. It is proposed to grow next year these 23 selections in five rod-row cultures and the remaining 31 in a single rod-row. The stand of the crop in wilt infected plots was very poor owing to want of moisture and the number of plants available for wilt study was below 15 in a majority of the selections. A large number of seeds of all these selections will be grown in wilt plot next year to study their wilt incidence and to make further selections from the surviving plants.

Crosses.—Segregates of the following crosses were studied during the year :—

(1) (Jarila × N.R. 5) F1 × New Million Dollar F1.

(2) (Jarila × N.R. 5) F2.

(3) (Jarila × New Million Dollar) F1.

Cross No. 1.—The object of this cross is to incorporate into Jarila the higher ginning percentage of N.R. 5 and 100 per cent. wilt resistance of New Million Dollar. 680 plants of the first generation of this cross were studied this year of which 124 plants have been selected for next year as they have a higher ginning outturn (39 to 45) than that of Jarila (33·3) and are equal to Jarila in staple length and earliness. These will be grown in single rows for further study. A large number of seeds of each of these will also be grown in wilt plot for the purpose of studying wilt incidence.

Cross No. 2.—The object of continuing this cross is to pick out a segregate akin to Jarila in all respects but possessing higher ginning value of N.R. 5 and to increase the genetic variance of the plant characters in general. 741 plants of the second generation of this cross were studied this year of which 36 plants with a higher ginning outturn (39 to 45), than that of Jarila have been selected.

Cross No. 3.—The object of making this cross is to incorporate into Jarila the 100 per cent. wilt resistance of New Million Dollar and to increase the genetic variance of the plant characters in general. This year the first generation plants have been backcrossed with Jarila. The backcrossed material will be grown in wilt infected plots next year for further isolations.

Wilt resistance.—The six plants from three sub-cultures of Jarila mentioned last year were transferred to the Plant Pathologist, Poona, for further isolations for 100 per cent. wilt resistance. Wilt incidence in the various strains and crosses during the year under report was as under :—

Name of cotton.	Number of plants observed.	Death Per cent. due to wilt.	Number of surviving plants selected for next year.
Jarila	36	0 00	....
N.R. 5	74	5·40	....
New Million Dollar	29	0·00	....
Cross 1	88	4·60	23
Cross 2	36	19·40	14
Cross 3	150	1·3	....
Dokras 121 lines 0 to 33	..	Not given. The plants observed per line being very few.	35

The selected plants mentioned in the last column of the above table will be tested further for wilt resistance as well as for agricultural and economic characters. Jarila as usual proved to be very highly wilt resistant and had no deaths this year.

Village trials of Jarila and local cotton.—This is the fourth year of the village trials of Jarila. Out of the 36 trials, Jarila yielded more than the local in 20, gave nearly equal results in 9 and yielded less than the local in 7 trials. Taking collectively, it yielded more than the local. The ginning percentage of Jarila varied from 32·0 to 35·5 against 33·0 to 38·0 of last year.

Farm trials.—Comparative yield trials of Jarila, Banilla and N.R. were resumed this year at the three farms, viz. Jalgaon, Bhadgaon and Dhulia. At Jalgaon there was no significant difference in yield between any two varieties. At Bhadgaon Jarila yielded more than N.R. only and at Dhulia it yielded better than the other two varieties. Both farm and district samples of the lint of Jarila were sent to the Technological Laboratory, Matunga, for spinning tests. Jarila from Jalgaon and Dhulia farms gave 30's and that from Bhadgaon farm gave 26's highest standard warp counts. These figures agree with those of the last year differing only by one or two counts. The results of the district samples are also very encouraging (28 to 35's). The sample which gave 35's comes from Salsingi. The results of mill tests on Jarila cotton are still awaited. The premium obtained for Jarila cotton in auction sales this year ranged from Rs. 13 to 34 over Broach per khandi (784 lbs.) of lint.

Selfed seed.—A nucleus for producing 200 lbs. selfed seed of Jarila was maintained at Jalgaon farm. The quantity actually produced was also 200 lbs. against 178 lbs. of last year. The whole of this seed will be grown next year on Jalgaon farm by the Farm Superintendent.

Jowar.—This is the fourth year of the yield trial of 4 jowar varieties and it was arranged in 8 replications as was done last year. The strains compared were No. 17, 41, 44 and Salsingi against local. The results were vitiated owing to severe attack of the beetles of Myllocerus spp. which damaged the young seedlings and caused gaps of different sizes in the plots. It is proposed to repeat the experiment next year.

Groundnut—Yield trails of Coimbatore groundnut strains.—The strains tried in 1938-39 were 113, 186, 334 and 477. Further details of the trial of these strains have become available this year from the Oil-Seeds Specialist, Coimbatore, and are summarized below :—

The fact that the strains 186 and 477 gave significantly increased yields over local was mentioned in the last year's report. These strains also show a higher natural test weight of pods per unit volume. No. 186 has given a higher shelling percentage (76·5) followed by the local (76·3). No. 334 has given the lowest (75·5). The percentage of diseased and immature kernals is very low in all strains (2·3 to 3·1) as against the local (13·1). Local has given the highest oil percentage (53·91), No. 186 standing next (52·25) and No. 477 going last (50·97).

At the request of the Oil Seeds Specialist, the trial was repeated this year. The strains sent were six which include the 4 of last year. Nos. 45 and 218 are the new strains and are reported to be early and of erect growth. All these six were tried along with local Spanish peanut in a Latin square of 7 × 7=49 plots. There was practically no difference between dates of first flowering in all these including local, while the date of close of flowering was about a week earlier in local. Harvesting of strains Nos. 218 and local could be done earlier by 10 days than that of the other strains. The statistical analysis of yield, oil percentage, etc., will be given when received from the Oil Seeds Specialist. From the average yield figures, however, it appears that strains 477, 186 and 113 have the chance of being significantly superior to the local.

Examination of Cotton Samples.

The Cotton Technological Assistant maintained from the funds of the Indian Central Cotton Committee continued to examine the samples of cotton received from the Cotton Breeders, Surat, Broach and Viramgam. He also tested the samples received from the Cotton Breeder, Jalgaon, who came under the administrative control of the Deputy Director of Agriculture, Northern Division, Surat, this year. The work done by him during the year may be divided into three sections: (1) Preliminary fibre tests by hand, (2) Laboratory tests and (3) Research work.

(1) *Preliminary fibre tests.*—The Cotton Breeders of Gujarat are required to judge the economic characters of their selected strains within a short period of about 3 months and plan their work for the next year as the crop is harvested in March and the next year's sowing commences in June. The laboratory tests take long time and the results are available long after sowing. The preliminary tests therefore have been necessary and the Technological Assistant helps the Cotton Breeders by visiting the Cotton Breeding Stations in the months of March, April and May and by examining the samples by hand. He used the instrument called tweezer this year and it has been found to be useful in drawing the bunch of fibres for examination. It removes loose and uneven hairs and brings the fibres into good alignment. During the year under report 2,425 samples of lint were tested by hand in this way (800 at Surat, 900 at Viramgam and 600 at Broach and 125 at Jalgaon) and the Cotton Breeders were enabled to select their material for the next year's sowing.

(2) *Laboratory fibre tests.*—During the year 212 samples were received for detailed laboratory tests (29 from Surat, 73 from Broach, 54 from Viramgam and 55 from Jalgaon) of which 173 were tested for Balls Sorter length, 45 for fibre weight, 66 for maturity and 5 for fibre strength. Among Surat samples, 8-1 × 1027 A.L.F. cross has given promising material. The samples from S. 9-1-4 were finer than 1027 A.L.F. but have lower maturity. The cross 22-3-2-8 has kept up its length but the maturity remains low. Among Broach samples the straight

crosses 76-1, 76-8 and 76-12 are promising because they possess good fibre length and maturity. Among Viramgam samples H.S. 12-1 is very fine and has good maturity and length. Among Jalgaon samples tested so far the Dokras selections from Chandor seem to be very promising, their staple length varying from 0·93″ to 0·97″ against 0·85″ of Jarila.

(3) *Research work.*—Measurements of swollen hair diameter of chief varieties of cotton grown in Surat and Broach tracts was the subject for investigation, with a view to find out if this examination could help one in differentiating one variety from another in a mixture. During the year under report, 1027 A.L.F. cotton was sorted out in different group lengths by the Balls Sorter and 100 fibres from each group were tested for their swelling with 3 re-agents viz., Sodium hydroxide, Zinc chloride and Potassium iodide in mercuric chloride. It was observed that Sodium hydroxide induces greater swelling than the other two. The values obtained however do not show significant variations between different group lengths. The work will be continued during the next season.

Crop Breeding at Nadiad.

Tobacco Bidee.—Character study of two selections K. 24 and K. 49 was made along with local Keliu in triplicate groups. K. 24 has long and slightly broad leaf; K. 49 has long and narrow leaf. In yield K. 24 is superior to K. 49 by 21·9 per cent. and to local by 48·2 per cent.; while K. 49 is superior to local by 21·5 per cent.

Comparative yield trials.—K. 24, K. 49, II-6-2-1 and local were tried in 4 replications. There was no significant difference in yield. The hybrid II-6-2 is the earliest to ripen and K. 24 is the latest. The difference between both being 10 days. Both K. 24 and K. 49 have a stronger smoking quality than the local which is needed for local use and trade. Two new varieties, Guntur local (also called White Ash) and Nippani were tried this year on the Farm. The performance of Guntur local was very discouraging. The spangle development was defective. The yield was low and leaf dimensions are shorter than those of Keliu. Nippani variety is sweeter and milder to smoke than Keliu when both are grown side-by-side.

Saijpur variety of tobacco which is grown on about 6,000 acres at and round Saijpur in Borsad taluka and which is useful for bidee, hukka and chewing purposes, was taken up for selection during the year. Mass seed from 20 intelligent growers in that tract was obtained and studied separately. There are some important differences in these 20 samples. 105 plants have been selected for further study.

Gigarette.—Plant-to-plant study in rows was made in 13 varieties. White Burley is found to be very delicate for this climate. Harrison Special, Adcock, Gold Dollar, Bonaza and Cash are found to be promising. Red Burley and (white Burley × P. 45) × White Burley were tried and smoking test will be taken after proper aging.

Comparative Economics of Bidee and Cigarette Tobacco.—Bidee tobacco K. 49 and Cigarette tobacco Harrison Special were grown for economic study. The cost of producing Bidee tobacco was Rs. 181–5–0 and the value of produce was Rs. 137–13–0 showing a net loss of Rs. 43–8–0 whereas the cost of producing cigarette tobacco was Rs. 301–2–11 and the value of produce was Rs. 154–8–0 resulting in a net loss of Rs. 164–8–11 per acre. The yield of Bidee tobacco was 1,258 lbs. and that of cigarette tobacco was 942½ lbs. per acre.

Maintenance of pure lines.—G. 6, II-6-2-1, N-1-5 and P-45 were maintained.

Successful raising of tobacco seedlings.—By use of Kantan shed for protecting seedlings from beating rains and strong sun-shine, the germination under shade was improved. The results of the experiment conducted were in favour of shade and confirmed those of the previous year.

Fungicides for controlling damping off.—Perenox, Bonisol and chesment compound were tried with control. Perenox and Bonisol are found to be promising.

Flue curing.—The cost of flue curing was during the year 0-1-5 per lb. of dry leaf and it seems that it is not possible to reduce the cost any more.

Seed Multiplication.—6½ lbs. of G. 6, 124 lbs. of K. 49, both one year open pollinated, and 4 lbs. selfed seed of Harrison Special were produced, this year for multiplication. According to the reports from the Rural Development Inspectors 92 lbs. G. 6. and 629 lbs. K. 49 seed were distributed to the public. K. 49 is much appreciated.

Bajri.—The bajri crop had to be given three irrigations during the year :—

(*a*) *Purity study.*—Thirty-four cultures selected for their significantly superior character values in the previous year were studied plant to plant each for its important character or characters. One culture for tillering, three for mainhead length, four for mainhead thickness and three for mainhead grain weight continued to stand superior to standard 207. Type 206-18 is significantly superior to St. 207 both in tillering and mainhead grain weight. Type 207-8 is significantly superior to St. 207 both in head length and mainhead grain weight and 207-26 is significantly superior to St. 207 both in head thickness and mainhead grain weight.

(*b*) *Yield determination.*—Twenty-five high yielding plants and 3 low yielding ones from plant to plant study series of each of the 4 high yielding selections were grown on line basis of about 200 plants along with St. 207 placed every 5th as a check. The order of merits on the basis of superiority over St. 207 was (1) 206-18 (18 per cent.), (2) 207-26 (11 per cent.), (3) 207-10 (5 per cent.) and (4) 207-8 (3 per cent.). The selection 206 has this year topped the list. The three low yield plant cultures in each selection gave at least the same yield as the mean of all

the 28 cultures of the respective selection indicating that they were not inherently low yielders but only environmental variations.

(c) *Comparative plant to plant study of local* vs. *St. 207 and sub-selection 207-8-1-53.*—Local mass seed from the crop of 1938-39 was compared on line basis of about 200 plants with St. 207 and selection 207-8-1-53 in 6 blocks. In tillering, the local proved the highest. In flowering dates, all were equal. For all other characters resulting in yield, selection 207-8-1-53 stood the highest and the local the lowest.

(d) *Yield trials under replications.*—Six sub-selections with 207 were tried in 7 replications. The results were insignificant. Only one sub-culture 207-10-3 gave lower (3 per cent.) grain yield. Sub-selection 206-18 recorded the highest (12 per cent.). All had higher straw and less chaff than St. 207. Selection 206-18 showed 24 per cent. higher yield of straw.

(e) *Maintenance of old selections.*—Old cultures Nos. 66, 128, 206 and 207 were maintained from selfed material.

(f) *New mass selection.*—Six new seed samples were procured and grown each to the extent of 200 plants. Promising plants have been selfed for further trial.

(g) *Production of selfed seed.*—In all 438 plants were selfed in three selections: 207-8-1 (48), 207-10-3 (26) and 207-10-73 (4).

(h) *Seed multiplication.*—Six hundred and fifty-seven lbs. seed from 207-8-1 was multiplied in the autumn of 1939 and 240 lbs. seed from 207-8-1-1 was multiplied in the summer of 1940. Both these have been handed over to the local Rural Development Inspectors for further multiplication in the district.

Castor.—Thirty-eight cultures in S-20-9-18, 4 cultures in S-5-10 and 6 cultures in S-5-35 were grown and studied for spike length and the filled spike length. The filled spike length, this year was found to have increased to 94·45 per cent. in S-20-9-18 and 94·5 per cent. in S-5-35.

Seed multiplication.—Six lbs. selfed seed was produced for farm use and 1,328 lbs. one year open pollinated seed was produced and supplied to the Rural Development Inspectors.

Crop Breeding at Dohad.

Maize.

Maize breeding work was just started in the year 1938-39. Selfing was found to be difficult and hence 12 different methods were tested during the year under report. Arabhavi method seems to be hopeful. Care is required to be taken to see that the tassel does not break while bending.

Selections.—Forty-five selfed and 135 non-selfed plants were selected from those under study during 1938-39 and these were grown during

this year and studied for a number of characters in the field and laboratory. Fifty-two plants from former and 37 plants from the latter have been selected for further trial.

Trial of different varieties.—Thirty-four American types and 7 Arabhavi strains were grown but none of them fared well. Most of these being coloured do not appeal to the local consumers. These will be rejected and only white ones will be tried again along with the three white seeded African types recently received.

Mass selected Farm Sameri seed multiplication.—Two seed multiplication plots were arranged and sown with mass selected seed which was obtained by selecting best plants from the standing crop of 1938-39. The undesirable plants were detasselled. The yield per acre of maize grain in these plots was 2,047 lbs. which is a record yield on Dohad Farm and in a year of scarcity like this.

Experimental Work.

Surat Agricultural Station.

Seed multiplication.—1027 A.L.F. cotton seed was multiplied on an area of 67 acres and 22 gts. (23 acres and 23 gts. of the farm itself and 43 acres and 37 gts. of the farm tenants). The average yield of seed cotton on the farm per acre was 520 lbs. which is fairly good for the low rainfall season. Roguing and thinning were done on the farm as usual. The total quantity of the seed produced was 18,207 lbs. which was handed over to the Cotton Superintendent, Surat, for further multiplication in the Surat tract as usual.

Budh Perio 53 jowar was grown on an area of 74 acres (24 acres farm area *plus* 50 acres tenants' area). The average yield of the farm was 744 lbs. per acre. Roguing was done as usual. 11,924 lbs. out of the resultant seed was distributed in the district through the Rural Development Inspector, Surat, and 2,939 lbs. outside Surat tract.

Growing of B.D. 8 cotton for Broach tract on this farm was discontinued during the year under report.

Dhaincha seed for green-manuring is attracting the attention of the cultivators in the Surat area. 300 lbs. seed was produced on the farm during the year and there was stock of about 500 lbs. seed of last year. After meeting the needs of the farm 255 lbs. seed was distributed in the district.

Comparative trial of jowar varieties.—Six varieties, viz. B.P. 53, Farm Perio, Althan Deshi, Moni Timbarva, Sholapuri and Chapti were maintained. Sholapuri and Althan Deshi gave higher yields of grain than others.

Manurial experiment (Sulphate of Ammonia) on cotton.—This experiment was discontinued during the year under report after 7 years, the results being conclusive as reported last year. The residual effects of Sulphate of Ammonia applied to cotton crop in 1938-39 were observed

on jowar crop in 1939–40. None of the treatments is significant over general mean. Control, farmyard manure, 20 lbs. Nitrogen at sowing and 10 lbs. Nitrogen after stand are significant over 40 lbs. Nitrogen after stand and 40 lbs. Nitrogen at sowing. Farm yard manure is also significant over 20 lbs. Nitrogen after stand. The results of fodder are not significant.

Cotton green manuring experiment.—This is the 6th year of the experiment which was started in 1934–35 [*vide* 6 (*e*) of the Annual Report for 1934–35]. Dhaincha crop was buried when it was about seven weeks old. Its average height and weight were as under :—

	Average height in inches.	Average weight of green stuff in lbs. per acre.
Farm yard manure ..	24	6,532
Without farm yard manure ..	19·12	5,218

The experiment was insignificant. Jowar is taken after cotton in rotation. Residual effects of the above experiment given to cotton last year were observed on jowar crop without any additional treatments. Grain results are insignificant while those of fodder are significant. No treatment is significant over general mean. Farm yard manure *plus* Dhaincha is significant over control and Dhaincha.

The average six years' economic results of a series which has completed six years will be given in the Annual Experimental records for the year 1939–40. During these six years, three cotton and three jowar crops were taken in this series. The results indicate that Dhaincha green manuring is better economically than farm yard manure and farm yard manure *plus* Dhaincha. It is not superior to control. The results are calculated per acre on the basis of small plots of about 2 gunthas each which naturally entail more expenditure than on a large scale plot. Dhaincha green manuring if practised on a field scale may pay economically and is worth experimenting.

Jowar green manuring experiment.—This experiment also which was started in 1934-35 has completed its 6th year. The season was favourable for establishing jowar crop after Dhaincha green manuring. Dhaincha was broadcasted on 19th June 1939 in dry soil as the rainy season was getting late and was ploughed in after 54 days when its average height and weight were as under :—

	Average height in inches.	Average weight of green stuff in lbs. per acre.
With manure	11·25	6,316
Without manure	10·12	6,101

Budh Perio 53 jowar was drilled in all the plots on 10th September 1939. The results were significant. Farm yard manure *plus* Dhaincha is significant over general mean, control, Dhaincha and farm yard manure.

Dhaincha and farm yard manure are significant over control and Dhaincha is also significant over farm yard manure. The fodder results are also significant. No treatment is significant over general mean and farm yard manure is significant over control.

The results are not quite comparable as the sowing of jowar in control plots was not done in the proper season. Cotton is taken in rotation to jowar and the residual effects of treatment given to jowar in 1938–39 were observed on cotton this year. The results were significant. Farm yard manure, Dhaincha and farm yard manure *plus* Dhaincha are significant over control. The average six years' economic results of this series which has completed six years will be given in the Annual Experimental Records for 1939–40. During these six years, three jowar and three cotton crops were taken in this series. The results show that Dhaincha green manuring is better economically than all other treatments even though the plots were only about 2 gunthas each which naturally entail more expenditure. It is likely to pay more on field scale.

Rotational experiment.—This is the 6th year of the experiment and was conducted as detailed in paragraph 40 of the Annual Report of 1935–36. Dhaincha was broadcasted on 15th July 1939 and ploughed in on 21st and 22nd September 1939 when its average height was 79·46" and average weight of green matter was 25,090 lbs. per acre. The results were significant. Cotton after Dhaincha fallow is significant over general mean and all other treatments.

Residual effects on the rotational crop of jowar were also observed. Both grain and fodder results were insignificant.

The green manure fallow treatment in 1934-35 had its control, jowar without any green manure. It has completed a cycle of six years having three cotton and two jowar crops, with control having three jowar and three cotton crops during these six years. The average six years' economic results will be given in the Annual Experimental Records for the year 1939–40. The results show that green manure fallow once in six years gives a net profit of about Rs. 7 per acre per year over control even though the treatment was only in two guntha plots. It is likely to pay more on field scale. The yield results in this experiment show that the effects of green manuring fallow do not continue to a satisfactory degree for more than two years; hence, with a view to maintain the standard of increased yield both of cotton and jowar in rotation, a new rotational experiment has been planned, the present one being discontinued. Soil samples from green manured and control plots have been sent for analysis and results are awaited.

New cotton manurial experiment.—With a view to combine various improvements in one experiment a new cotton manurial experiment was laid out during the year under report with five treatments and five replications according to Latin square method. The treatments were :—

(A) Cotton with no manure (control).

(B) Cotton with 1 foot Dhaincha green manure strip in the middle.

(C) Cotton with 10 lbs. Nitrogen in the form of Sulphate of Ammonia after stand *plus* 1 foot Dhaincha strip.

(D) Cotton with 20 lbs. Nitrogen in the form of Sulphate of Ammonia after stand *plus* 1 foot Dhaincha strip.

(E) Cotton with 40 lbs. Nitrogen in the form of Sulphate of Ammonia after stand.

The results of the experiment were insignificant.

Spacing experiment.—With a view to see the effects of different spacing in cotton the following new experiment was laid out during the year under report with four treatments and four replications according to Latin square method :—

(A) Cotton drilled 3 feet × 1 foot (control).

(B) Cotton dibbled 6 feet × 2 feet one way interculturing.

(C) Cotton dibbled 6 feet × 2 feet cross interculturing.

(D) Cotton drilled 6 feet × 2 feet.

The results of the experiment indicate that (C) is significant over (A) and (D).

Dohad Agricultural Station.

Trial of wheat varieties.—Five Pusa strains of wheat Nos. 4, 52, 111, 80-5 and 101 were tried in five replications according to Latin square method. Pusa 4 was found superior to others. Pusa 4 wheat seed was multiplied on an area of 3 acres 6 gunthas and a yield of 3,176 lbs. was obtained for distribution in the district.

Trial of groundnut varieties.—Six varieties received from the Oil Seeds Specialist, Coimbatore, viz., A.H. 45, 334, 186, 113, 447 and 218 were tried along with Spanish peanut in seven replications according to Latin square method. The results have been sent to the Oil Seed Specialist for interpretation but they indicate that No. 113 is better than others. These are all late varieties and are difficult to be harvested.

Jalgaon Agricultural Station.

San green manuring to wheat.—The object of this experiment is to see if san green manuring helps to increase the yield of wheat crop in the same year. The experiment was conducted in six replications according A B B A method. The result was insignificant like that of the previous three years. The experiment will be discontinued.

Trial of Napier grass.—The habit of the growth of this plant is somewhat erect. After first cutting the grass made very poor growth. After the second cutting the plants did not make any growth of leaves at all. Observations will be continued.

Seed multiplication.—In all 13,520 lbs. Jarila cotton seed (3,970 from the farm area and 9,550 lbs. from the tenants' area) was raised and

supplied to the Cotton Superintendent, Jalgaon for further multiplication in the district. Similarly, 5,945 lbs. wheat seed No. 224 (1,625 lbs. from the farm area and 4,320 lbs. from the tenants' area), 12,695 lbs. wheat seed No. 168 (1,895 lbs. from the farm area and 10,800 lbs. from tenants' area) and 650 lbs. wheat seed No. 808 (all from the farm area) were raised for distribution in the district.

Six new experiments have been planned during the year taking into consideration the requirements of the tract and they have received the approval of the Director of Agriculture. These are :—

(1) Spacing experiment in cotton.

(2) Manurial experiment on cotton with different quantities of farm yard manure and groundnut cake available in the tract.

(3) San green manuring in different ways to substitute farm yard manure.

(4) San green manuring in different forms to substitute farm yard manure.

(5) Rotational experiment.

(6) Deep V/S shallow tillage experiment.

These will be laid out during the next season.

Bhadgaon Agricultural Station.

The object of this farm is to raise Jarila cotton seed in the I, II and III stages. During the year under report 300 lbs. selfed seed and 2,875 lbs. II Stage seed were obtained. The selfed seed will be grown on an area of 15 acres in the II Stage and 2,874 lbs. II Stage seed will be grown on about 100 acres on tenants' cultivated area in the III Stage next season. The rotation crops grown on the farm were groundnut (Spanish peanut), jowar (Aispuri) and bajri (Akola).

Experiments in the district.

Yield tests of cotton in the water-logged areas of Olpad taluka.—These tests were conducted in accordance with Government Resolution, Revenue Department, No. 8415/28, dated 12th June 1936, and this is the 3rd year. The object is to ascertain the yields of water-logged fields for which remission is given to the owners and those in non-water-logged ordinary fields in the neighbourhood for which no remission is given. They were conducted at Mulad and Kudsad villages and were 8 in number. In six cases the yields were less (9·21 to 47·72 per cent.) and in two cases higher (24 to 27 per cent.) than those of non-water-logged plots. The average decrease was 21 per cent. whereas the average increase was 25·5 per cent. It is proposed to continue these tests for two more seasons on a larger scale under Government Memorandum, Revenue Department, No. 8415-A/28, dated 30th December 1938.

IV. Agricultural Education.

Dhulia Agricultural School.—The Agricultural School at Dhulia has now completed its 16th year. In all 188 applications were received for admission to the school from East Khandesh, West Khandesh and Nasik Districts. The Local Agricultural School Committee called 40 applicants for interview and selected 21 candidates. With 19 students in the 2nd year the total strength of students in the school was 40 during the year under report. This number was formerly limited to 30 but was increased to 40 during the current year with the consent of the Director of Agriculture, Bombay Province, Poona. The result of the annual examination was satisfactory. All the 19 students in the 2nd year and 19 out of 21 in the 1st year were declared successful. There was no change in the curriculum.

Equipments for practical teaching continued to be good. Fruit, flower and vegetable gardens have been developed. The poultry section was transferred to the Live Stock Expert at the end of the year. Carpentry, smithy and weaving continued to be the by-industries taught. The students had sufficient practice in running the oil engine for pumping water. They prepared compost manure from farm refuse. With increased number of students, it is rather difficult for the Head Master to teach both theory and practicals single-handed. The necessity of an assistant teacher (preferably an agricultural graduate) is keenly felt.

The boys received a stipend of Rs. 6 each per month for 10 months (the period of their stay in the school) from the Local Advisory Committee and managed their boarding on club system under the guidance of the Head Master. The average expenditure per boy came to Rs. 5-12-0 per month including the pay of the cook, servant and hostel lights.

The Local Agricultural School Committee of nine members with Rao Saheb B. R. Ransing, B.A., LL.B., Pleader, Dhulia, as their Chairman continued to work during the year under report and met thrice to discuss the school problems and to allot scholarships to the students. The committee received Rs. 2,025 as donations and spent Rs. 2,531 as stipends to students. They have a balance of Rs. 4,369-8-1 on hand (on 31st March 1940). The committee deserves thanks for the continued interest it has been taking. The total receipts of the school farm with an area of 25 acres under cultivation amounted to Rs. 2,140 during the year against Rs. 1,724 of last year. Though the season was unfavourable, yet the yields of crops grown on the school farm were normal. Jarilla cotton grown as dry crop on 8 acres 10 gunthas gave on an average 440 lbs. and that grown with one pre-irrigation on 30 gunthas, 924 lbs. seed cotton per acre. The yield of groundnut was 1,268 lbs. Akola bajri 811 lbs. and Pusa wheat 1,280 lbs. per acre. The adjoining cultivators reaped poor harvests and the students had a good chance to compare these with reasons.

The school farm is mainly the training ground for the students but has also rendered valuable service to the cultivators by affording the supply of pure seed of different crops and poultry birds worth Rs. 791-12-0 during the year.

His Excellency Sir Roger Lumley, G.C.I.E., T.D., the Governor of Bombay and Mr. H. F. Knight, I.C.S., Advisor to His Excellency visited the school during the year and saw its activities.

Primary and Secondary Schools with Agricultural Bias.—The Superintendent, Surat Farm examined the students of the Primary School Final Examination at Surat Centre and the Cotton Breeder, Surat, examined the students of the English High School at Godhra in Agriculture. The Deputy Director of Agriculture, inspected the school at Godhra when on tour and made suggestions for its improvement.

General.

The activities of the Agricultural Department having been restricted to Research experiments and Education, the Deputy Director of Agriculture extended his activities in investigating the important problems of the cultivators and prepared in different tracts of his Division the following schemes under the direction of the Director of Agriculture for submission to the Imperial Council of Agricultural Research and the Indian Central Cotton Committee for financial help :—

(1) Five-year scheme for scientific work on the improvement of the rice crop in Gujarat with two small experimental stations, one at Navagam for Ahmedabad and Kaira Districts and the other at Bulsar for Surat and North Thana Districts at a total cost of Rs. 76,037 (Rs. 16,645 capital *plus* Rs. 59,392 recurring). This has received the approval of the Bombay Provincial Agricultural Research Committee and the Imperial Council of Agricultural Research.

(2) Model agricultural project for developmental research in the introduction of all agricultural improvements in Dohad and Jhalod Talukas of the Broach-Panch Mahals District at a total cost of Rs. 18,820 (Rs. 2,415 capital *plus* Rs. 16,405 recurring) in five years. This has received the approval of the Bombay Provincial Agricultural Research Committee.

(3) Model agricultural project for developmental research and in the introduction of all agricultural improvements in the cotton tract of the Surat District at a total cost of Rs. 16,300 (Rs. 2,785 capital *plus* Rs. 13,515 recurring) in five years. This has received the approval of the Indian Central Cotton Committee and the Bombay Provincial Agricultural Research Committee.

(4) A scheme for botanical improvement of wheat crop with breeding stations at Arnej for dry and Dholka for irrigated wheat in the Bhal tract of Ahmedabad District at a total cost of Rs. 78,027 (Rs. 31,020 capital *plus* Rs. 47,007 recurring) in 5 years.

(5) Scheme for botanical improvements of jowar crop with a breeding station at Sanand in Ahmedabad District at a total cost of Rs. 51,096 (Rs. 20,460 capital *plus* Rs. 30,636 recurring) in five years.

(6) Scheme for the extension of botanical improvement of bajri crop at Nadiad in Kaira District at a total cost of Rs.34,890 (Rs. 10,865 capital and Rs. 24,025 recurring) in five years.

(7) Scheme for the improvement of cotton crop in Kaira District at a total cost of Rs. 13,100 (Rs. 300 capital *plus* Rs. 12,800 recurring) in five years. This scheme has been approved by the Indian Central Cotton Committee on the condition that the Bombay Government would take the necessary action to have Kaira District notified as a protected area under the Cotton Transport Act, 1923, prior to the work under the scheme being commenced.

Programme of work to be done under the Deputy Director of Agriculture, Northern Division, Surat, for the year 1940-41.

RESEARCH.

SURAT.

(*a*) *Cotton.*

I. Isolation of a type equal to 1 A.L.B. in seed cotton yield and ginning percentage and equal to 1027 A.L.F. in staple qualities by :—

(*a*) Further selection and purification in S. 9-1-4, S. 5, S. 44, S. 45 and S. 47.

(*b*) Intensive study by further selection from the pure lines :— Comparative study for economic characters of the selected cultures and their progenies with 1027 A.L.F. as check :—

Type.	No.	Selected cultures. Name.	Number of progenies.
1027 A.L.F.	3	1027 A.L.F.-1,1027 A.L.F.-16, 1027 A.L.F. 21.	7 progenies in each culture.
Seg. 8-1 ..	3	Seg. 8-1-1, Seg. 8-1-2, Seg. 8-1-6.	4 progenies in each culture.
S. 9-1-4 ..	4	S. 9-1-4-2, S. 9-1-4-5, S. 9-1-4-14, S. 9-1-4-18.	4 progenies in each culture.

(*c*) Study of the crosses and back crosses :—

(1) Further selection and purification in :—

(*a*) 5 cultures of (Seg. 8-1 × 1027 A.L.F.) F-6 (Nos. 5-7-8-14-15).

(*b*) 1 culture of (Seg. 8-3 × 1027 A.L.F.) F-7 (No. 2).

(*c*) 1 culture of [(B.D. 8 × 1 A.L.B.) F-1 × 1027 A.L.F.] F-7 (No. 24).

(2) Selection from the crosses :—

(*a*) (1027 A.L.F. × B.C. 1-6) F-2.

(*b*) (Seg. 8-1 × B.C. 1-6) F-2.

(*c*) (Seg. 22-3-2-8 × B.C.-1-6) F-2.

(*d*) 1027 A.L.F. × (1027 A.L.F. × B.C. 1-6) F-1.

(*e*) 1027 A.L.F. × (Seg. 8-1 × B.C. 1-6) F-1.

II. Comparative yield trials of :—

(*a*) 1027 A.L.F., 1 A.L.B., Seg. 8-1 and S. 9-1-4.

(*b*) Preliminary yield test of bulk seed of 16 promising cultures with 1027 A.L.F. as check.

1. S. 9-1-4—4 cultures.
2. Seg. 8-1—2 cultures.
3. 1 A.L.B.—1 culture.
4. S. 5.—2 cultures.
5. Seg. 8-1 × 1027 A.L.F. F-6—5 cultures.
6. Seg. 8-3 × 1027 A.L.F. F-7—1 culture.
7. (B.D. 8 × 1 A.L.B.F. 1) × 1027 A.L.F. F.-7—1 culture.

(*c*) Village trials of 1027 A.L.F., Seg. 8-1 and 1 A.L.B. at 5 centres in South Gujarat.

III. Production of selfed seed of 1027 A.L.F. (300 lbs.), 1 A.L.B. (100 lbs.), Segregate 8-1 (100 lbs.), and B.D. 8 (30 lbs.).

IV. Maintenance of thirty-two types.

V. Sowing of cotton with " wal " for economising selfed seed.

(*b*) *Jowar.*

I. Maintenance of 20 types.

II. Production of selfed seed of Budh Perio 53.

Interspecific Hybridization.

(1) Maintenance of the hybrids and their first backcross plants by ratooning and vegetative propagation.

(2) Continuation of the trials for inducing fertility by :—

(*i*) Backcrossing and

(*ii*) Chemical treatment with colchicine.

(3) Study of first backcross plants and promising material selected therefrom.

(4) Exploration of the economic possibilities of polyploidy in cottons induced by colchicine treatment.

(5) Raising of various foreign cultivated and wild cottons for use in crossing.

(6) Cytological study of hybrids, their first backcross plants and colchicine treated material.

BROACH.

Cotton.

I. *Crosses.*—

(1) Study of single plant progenies of the following crosses with the object of maintaining the desirable segregates already isolated and evolving suitable new ones :—

(*a*) (B.D. 8 × G.A. 26) F-10.

(*b*) $\left\{(\text{B.D. 8} \times \text{G.A. 26}) \times \text{B.D. 8}\right\}$ F-8.

(*c*) (B.D. 8 × S. 7-1) F-8.

(*d*) (B.D. 8 × (B.D. 8 × S. 12-1) F-6.

(2) Trials of Segregates 76-1, 76-12 from (B.D. 8 × G.A. 26) F-9, 1-2, 1-6, 5-18 and 7-29 from $\left\{(\text{B.D. 8} \times \text{G.A. 26}) \times \text{B.D. 8}\right\}$ F-7 and 3-1 from $\left\{\text{B.D. 8} \times (\text{B.D. 8} \times \text{S. 12-1})\right\}$ F-5 :—

(A) To test three best plants from each of the two segregates viz., 7-29 from $\left\{(\text{B.D. 8} \times \text{G.A. 26}) \times \text{B.D. 8}\right\}$ F-7 and 3-1 from $\left\{\text{B.D. 8} \times (\text{B.D. 8} \times \text{S. 12-1})\right\}$ F5 for wilt resistance (with selection 1 A.L.B. and B.D. 8 as susceptible and resistant checks respectively) in a highly wilt-infected plot and for other characters (with B.D. 8 as a check) in a wilt-free plot in 9 random replications as per split plot technique.

(B) The bulk seed of each of the seven segregates mentioned under (2) to be used for varietal trials with B.D. 8 and Broach Local as checks in 6 random replications in wilt-free plot.

(C) District trials of Segregates 76-1, 1-2 and 1-6 at four centres in the Broach District. Three centres would be in black soil of Broach and Wagra Talukas and one in Gorat soil of Jambusar Taluka.

II. *Maintenance of fixed types*—Sixteen types—3 Deshi, 6 Goghari, B. 9^1 (a synthetic type), 2 selections—N.S. 12 and N.S. 49, 2 Viramgam segregates—S. 7-1 and S. 12-1 and 2 mutants—3-4 celled and 4-5 celled to be maintained pure by selfing.

III. *Seed multiplication.*—Multiplication of B.D. 8 on one acre for pure seed supply to the district.

VIRAMGAM.

(*a*) *Cotton.*

(1) Further selections of Wagad cottons by growing in (*a*) progeny rows with Wagad 8 as check and (*b*) a trial on small scale replications of types including the promising ones such as N. 89-2, 115 and 126.

(2) Further selection and purification of cultures from the crosses of Wagad types with Surtee-Broach quality cottons and the backcrosses.

(3) Selection for earliness combined with other economic characters from the F3 crosses with Russian, Persian and also from the backcrosses of these cottons.

(4) Comparative tests of Wagad 8, Local-Wagad, No. 89-2 and H.S. B-1 and Seg. 4-1.

(5) The spacing experiment of 2′ × 2½′ between the rows will be started.

(*b*) *Jowar.*

(1) Yield trials of 4 selections, viz., C-8-2, C-10-2, U-11-4 and U-3-4, with local Chhasatio and Utavali.

(2) Progeny row testing of 6 selections of 1933-34 and 29 selections of 1937-38.

(3) Growing of 25 selected heads from each of Chhasatio and Utavali for further selection.

JALGAON.

(*a*) *Cotton.*

(1) Isolations of types from Dokras cotton from Chandur giving higher ginning percentage than that of Jarila. Study of the 54 promising lines of last year.

(2) Study of the segregates from the following crosses :—

(*i*) {(Jarila × N.R. 5) F 1 × New Million Dollar} F 2.

(*ii*) (Jarila × N.R. 5) F 3.

(*iii*) {(Jarila × New Million Dollar) F 1 × Jarila} F 1.

(3) Making selections for wilt resistance in the various cultures of Dokras cotton and the three crosses mentioned under item 2.

(4) Comparative yield trials of Jarila, Banilla and N. R. 6 at Jalgaon, Bhadgaon and Dhulia farms.

(5) Laboratory tests of farm and commercial samples of Jarila.

(6) Mill tests of commercial bales of Jarila (will be taken if possible).

(7) Maintenance of the nucleus of pure seed of Jarila.

(8) Village trials of Jarila and local cotton in Khandesh if funds permit.

(*b*) *Jowar.*

Yield trials of jowar strains.

(*c*) *Groundnut.*

Yield trials of Coimbatore groundnut strains.

Examination of cotton samples by the Technological Assistant, Surat.

(1) Preliminary fibre tests with hand at Surat, Broach, Viramgam and Jalgaon.

(2) Laboratory fibre tests of samples received from the Cotton Breeders, Surat, Broach, Viramgam and Jalgaon.

(3) *Research.*—(*a*) Continuation of the work on the experiment of swollen hair diameter, (*b*) Comparison of different methods of staple length examination by hand with a view to find one which is most suitable and (*c*) Fibre characters of different pickings of 1027 A.L.F., B.D. 8 and Jarila cottons.

NADIAD.

(*a*) *Tobacco.*

(1) *Bidee tobacco.*—

(1) (*a*) Selection breeding in the Keliu variety plant-to-plant study of K. 24, K. 49 and local for purity determination.

(*b*) Comparative yield trials under replication of the above mentioned 3 types.

(2) Selection breeding in the Saijpur variety—Detailed study of 100 individual plant selections to isolate the best ten.

(3) Leaf quality study of the Nippani variety and White Burley × P-45 cross.

(2) *Cigarette tobacco.*—

(1) Character study of 15 virginian varieties to determine the one best for the tract.

(2) Study of the comparative economics of bidee tobacco and cigarette tobacco production.

(3) Maintenance of pure seed of 4 old selections.

(4) Study in the control of the "damping off" disease in tobacco seedlings in collaboration with the Plant Pathologist to Government.

(5) Multiplication of the selfed and open pollinated seed of 3 bidee selections and 1 cigarette selection.

(*b*) *Bajri.*

(1) *Selection Breeding.*—

(1) Plant-to-plant study of 24 selections for various characters, leading to yield, to determine purity.

(2) Yield determination of 5 selections in 28 sub-selections on line basis.

(3) Comparative yield trials under replication of 8 high yielding sub-selections with St. 207 and local.

(2) Supplementary studies :—

(1) Testing the yield of the selfed *v/s* unselfed earhead of the same plant.

(2) Testing the yield of earheads with many spikelets *v/s* earheads with the usual 2 spikelets.

(3) Testing the yield of the latest selection 207-8-1-1 with the original selection 207 spreading in the tract.

(4) New selections from the mass seed.—Testing 50 earheads selected on the farm and in the tract.

(5) Production of selfed seed from the leading selection 207-8-1-1 in the Autumn and the following summer.

(*c*) *Castor.*

Production of selfed seed from the two selections S-20 and S-5.

DOHAD.

(*a*) *Maize.*

(1) Study of the floral parts of maize plants.

(2) Study of the methods of selfing in maize plants.

(3) Selections made from 1939–40 progenies to be grown and studied for further purification and selection work.

(4) Fresh selection made from the district to be grown and studied.

(5) Mass selected farm Sameri seed to be multiplied detassaling undesirable plants.

(*b*) *Wheat.*

(1) Trial of Pusa 4, 52, 101, 111 and 80-5 wheat varieties.

(2) Multiplication of Pusa 4 wheat.

(*c*) *Groundnut.*

Trial of Madras groundnut varieties against Spanish peanut.

EXPERIMENTAL WORK.

Surat Farm.

A. Existing experiments to be continued or dropped :—

(1) Maintaining jowar varieties about 2 gunthas each to be continued.

(2) Cotton green manuring and its residual effects on next jowar crop—to be continued.

(3) Jowar green manuring and its residual effects on next cotton crop to be continued.

(4) Rotational experiment to be dropped as the results have been conclusive.

(5) New manurial experiment on cotton (Sulphate of Ammonia and Dhaincha) to be continued. Its residual effects on next jowar crop to be observed.

(6) Cotton spacing experiment to be continued.

(7) Growing of Dhaincha varieties and selection work to be continued.

(8) Trial of Java Sann to be continued.

(9) Trial of Ridgers to be further taken after final improvement by the Mechanical Assistant, Surat.

(10) Trial of Napier grass to be dropped as it is not promising.

(11) Trial of Allan-Gandhi Hoe with adjustments.

(12) Replication tests of cotton varieties 1027 A.L.F. and Segregate 8-1 in the area of one of the tenants to be taken jointly with the Cotton Breeder, S. G., Surat on 10 guntha plot each—duplicate series.

B. New experiment :—

New rotational experiment (combining all green-manure treatments) to be conducted according to the plan approved by the Director of Agriculture, Bombay Province, Poona.

Dohad Farm.

The following new experiments will be conducted on Dohad Farm :—

(1) San green manuring in between maize rows 3′ apart followed by dry rabi wheat *v/s* Maize drilled 2′ apart followed by dry rabi wheat.

(2) San green manuring in between maize rows 3′ apart followed by irrigated rabi wheat *v/s* maize drilled 2′ apart followed by irrigated rabi wheat.

(3) Maize and tur as a mixed row crop with two rows of maize 2′ apart in between 2 tur rows 6′ apart followed by no winter crop *v/s* Maize drilled 2′ apart followed by gram as non-irrigated rabi crop.

(4) Maize and tur as a mixed row crop with 2 rows of maize 2′ apart, in between 2 tur rows 6′ apart followed by no winter crop (tur to be given one irrigation) *v/s* maize drilled 2′ apart followed by irrigated rabi wheat.

Jalgaon Farm.

The existing san green manuring experiment will be discontinued.

The following new experiments based on the requirements of Khandesh tract will be conducted :—

(1) Spacing experiment in cotton—to find out under what spacings between rows and plants the maximum yield of cotton is obtained.

(2) Manurial trials in cotton—to find out the best dose of farm yard manure either alone or in combination with oil cake manure to get the maximum yields.

(3) San green manuring to cotton—to see the effect of san grown alone, followed by wheat in the same year or in combination with tur on the cotton crop of the following year.

(4) San green manuring in different forms to cotton—to see whether composting of san is better or burying in.

(5) Rotational experiments—to see which is the best rotation for cotton.

(6) Tillage experiments—to make available the plant food material contained in the deeper layers of the soil, by deeper tillage.

Bhadgaon Farm.

(1) 300 lbs. selfed Jarila cotton seed will be raised by selfing the flowers in the nucleus area.

(2) The selfed seed of previous year will be sown in Stage II on 15 acres for multiplication.

(3) Trial of Jarila, Banilla, and N. R. cottons in 8 replications will be continued.

(4) Trial of Aispuri jowar No. 44 in comparison with the local jowar.

Agricultural School, Dhulia.

The poultry section has been transferred to the Live Stock Expert to Government recently and located on a part of the school farm. The students will continue to get their training there. This transfer necessitated certain alterations in the cropping scheme of the school farm which were effected. There is no other change in the activities of the school.

General.

(1) All preliminary work will be undertaken to establish Rice Breeding Stations at Nawagam in Kaira District and Bulsar in Surat District after receiving necessary orders from the Director of Agriculture.

(2) Model agricultural project for introducing all agricultural improvements at Mirakhedi in Dohad Taluka and at Rayam in Bardoli Taluka will be taken up after hearing from the Director of Agriculture.

(3) Crop cutting experiments in the water-logged areas of the Olpad Taluka will be continued.

APPENDIX C.

Summary of work done under the Livestock Expert to the Government of Bombay, Poona, for the year 1939-40.

Personnel.—Mr. Edw. J. Bruen held charge of the Livestock Section for the whole of the year. The work done by the Livestock Expert to Government may be divided under the following headings :—

(1) Control and guidance in the conduct of Government Livestock Farms and supply of Pedigreed Livestock for improvement in villages.

(2) Co-operation with the non-official cattle Breeding Farms for improvement of cattle.

(3) Supervision and guidance of work on Livestock Research Scheme Farms financed by the Imperial Council of Agricultural Research.

(4) Control and guidance of work done by the District Livestock staff in the improvement of Livestock.

(5) Initiation of livestock improvement and Dairy District Schemes for further development.

(6) Work in connection with the Provincial Fodder and Grazing Committee in the capacity of Joint Honorary Secretary.

(7) Work in connection with the Animal Husbandry Wing of Imperial Council of Agricultural Research and the Central Fodder and Grazing Committee.

(8) Judging of cattle at Provincial Cattle Shows and the All-India Cattle Show.

(9) Rural Uplift Work as far as Livestock Improvement is concerned.

(10) Advisory work.

The progress made during the year under each of the headings is embodied in the following report. The activities of this section mainly are :—

(*i*) The Advisory work.

(*ii*) Propaganda and teaching in villages.

(*iii*) The breeding of pure bred stock and their improvement on Government Farms ; on Farms financed by the Imperial Council of Agricultural Research and on subsidized private Cattle Breeding Farms.

(*iv*) The improvement of cattle in villages by placing out pure bred premium bulls.

(*v*) The improvement of village poultry by introduction of pure bred fowls.

(*vi*) The encouragement of keeping better cattle by holding Shows, Rallies and Demonstration.

(*vii*) The improvement of the milch buffalo.

(*viii*) The registration of pure bred stock of the various breeds in Breed Herd Registers and formation of Breed Associations.

(*ix*) Propaganda in storage and utilisation of fodder in the form of hay and silage.

(*x*) The working of His Excellency the Viceroy's Gift Bull Scheme.

(*xi*) The working of the Livestock Improvement Act.

(*xii*) Efforts to secure the co-operation of the Panjrapoles and Gowshalas in the improvement of cattle.

(*xiii*) Working of the Milk Recording Scheme financed by the Imperial Council of Agricultural Research.

(*xiv*) *Research work on Goat-Breeding.*—Testing the milking capacity of the Kamori Goat of Sind.

Advisory Work.—During the year under report Government have approved to concentrate all district Livestock Improvement Work under the control of the Livestock Expert. The demand for advice in respect of all matters connected with the improvement and development of Livestock work has been steadily increasing. The most salient matter that came up for advice during the year are mentioned below :—

(*i*) *The National Planning Committee Work on Animal Husbandry and Dairying.*—I was asked to draw up a comprehensive questionnaire on Animal Husbandry and Dairying in India. I attended the meetings of the above sub-committee twice during the year and I am glad to say the Committee agreed with my views on the steps to be taken for the improvement and development of Animal Husbandry and Dairying in India. As a result the Committee approved the recommendations made in the Report of the Bombay Expert Cattle Committee (1940) and have recommended them to be taken as the basis of work *mutatis mutandis* in other Provinces and States.

(*ii*) *Ghee Adulteration.*—The evil of adulteration of ghee has spread far and wide in the country and is consequently ruining the cattle and dairy industry. The Director of Agriculture, Bombay Province, Poona, on receipt of reference from Government appointed a Committee consisting of the Livestock Expert to Government of Bombay as Chairman ; the Professor of Agricultural Economics and Provincial Marketing Officer and the Agricultural Chemist to the Government of Bombay, for the detailed consideration of the matter in order to check this malpractice. The Committee met thrice and secured the assistance of Col. Dabholkar, the Director of Public Health, Bombay Province Poona, in this connection.

The findings of the Committee have been submitted to the Director, of Agriculture, Poona, for the consideration of Government. The orders of Government on the recommendations of the Committee are being awaited.

(*iii*) *Definition of Breed Characteristics of the Khillar Breed of Cows and the Surti Breed of Buffaloes.*—The Imperial Council of Agricultural Research appointed me as the convener for the definition of breed characteristics of the above breeds. The work in connection with the definition of the Khillar breed was done at Pandharpur in Sholapur District on 16th to 18th January 1940 while the definition of the characteristics of the Surti breed of buffaloes was done at Samarkha near Anand in Kaira District on 12th March 1940 with the assistance of local cattle breeders and other officials. Full reports together with the necessary measurements and photos for each of these breeds have been submitted to the Imperial Council of Agricultural Research during the year.

(*iv*) *Scheme for improving the Butter and Ghee Industry in Karnatak and Khandesh.*—A scheme outlining the measures to be taken to improve the butter and ghee production in villages was prepared and submitted to the Director of Agriculture, Poona, for consideration of Government.

(*v*) *Schemes submitted to the Imperial Council of Agricultural Research, New Delhi.*—The following schemes were submitted to the Imperial Council of Agricultural Research, New Delhi, for consideration and approval.

(1) Scheme for drying of green grass.

(2) Scheme for development of scientific research work in sheep breeding as an expansion of the Sheep Breeding Scheme, Poona, to provide for three sub-stations.

(3) Scheme for the expansion of the Sheep Breeding Research Scheme, Poona, to provide necessary facilities for wool analysis.

(*vi*) *Initiation of Provincial Livestock Improvement Schemes.*—The following schemes which were submitted have been sanctioned during the year under report :—

(1) Reorganisation of the Tegur Cattle Farm and its continuance as a nucleus for the establishment of small herds of Dangi and Nimar cattle for the production of suitable dual purpose cattle, particularly for the Konkan Division.

(2) Establishment of Poultry Farms at the Dhulia Agricultural School and Dharwar Farm to serve as training centres for farmers in poultry keeping.

The above schemes are dealt with separately in this report.

(*vii*) *Palghar Dairy District Scheme.*—Early in January 1940 I was asked to meet Mr. Knight, Adviser-III to His Excellency the Governor of Bombay to discuss the details of the scheme. This scheme aims at supplying of milk to the city of Bombay by the establishment of milch cattle stables and sufficient number of dairymen in Palghar taluka of Thana District where grazing lands are available. The keeping of milch cattle in large cities has led to the destruction of many useful cows and buffaloes and thousands of

calves, which today may have been producing large quantities of milk had they been kept under more natural and more economical conditions. During the year a letter was addressed to 63 milch cattle stable owners in Bombay to ascertain if they are willing to erect cattle stables in Palghar taluka if they are provided with lands on a concession rate there. Some 10 applicants have asked for lands in Palghar taluka and the matter has been referred to Government for their consideration.

(*viii*) *Co-operation with Gowshalas and Panjrapoles in the improvement of cattle.*—The institutions were visited personally by the Assistant Livestock Expert in order to ascertain whether these institutions were prepared to co-operate with Government in future work towards cattle improvement in the Province and to ascertain on what conditions such co-operation might be secured from each institution individually. The Gowshalas and Panjrapoles maintained at the following places were visited (1) Jalgaon, (2) Chalisgaon, (3) Nandurbar, (4) Malegaon, (5) Nasik, (6) Gowardhanwadi, Poona, (7) Sholapur, (8) Barsi, (9) Karad and (10) Broach. A detailed report on these institutions has been submitted to Government. So far the only institution which is prepared to co-operate on explicit terms is the Shree Barsi Gowrakshan Mandal (District Sholapur). Their terms of co-operation have been forwarded to Government for consideration.

Propaganda and District Livestock Work.—The demand for better cattle, poultry, sheep and goats is on the increase and far exceeds our resources to supply the same. During the year the district staff for the Livestock Improvement Work remained the same as for the last year except the addition of one Inspector of Poultry Breeding. Thus the total strength of the district staff was as under :—

1 Assistant Livestock Expert.

5 Divisional Inspectors of Cattle Breeding.

2 Inspectors of Poultry Breeding and

9 Cattle Kamgars.

The work done by the district staff may be outlined as under :—

(*a*) Working of the Premium Bull Scheme.

(*b*) Working of His Excellency the Viceroy's Gift Bull Scheme.

(*c*) Working of the Cow Premium Scheme.

(*d*) Registration of Pure Bred Cattle.

(*e*) Application of the Bombay Livestock Improvement Act, 1933.

(*f*) Shows, Rallies and Demonstrations.

(*g*) Poultry Improvement in villages.

(*h*) Improvement of the Milch Buffalo.

(*i*) Feeding trials—(Anjan and Tivir leaves).

(*j*) Acquainting District Social Workers with the work done by this section.

The work done under each of these is detailed below :—

(*a*) *Working of the Premium Bull System.*—Under this scheme cattle breeders or agents are supplied with pure bred stock of bulls in either of the following ways.

(*i*) If the cattle breeders or agents contribute full cost for the purchase of breeding bulls, maintenance charges at the rate of Rs. 5 to Rs. 7 per mensem are given for the proper upkeep of the bulls for a period of three years :—

(*ii*) If they contribute half the cost, the other half is contributed by Government. In this case no maintenance charges are given.

(*iii*) In the case of poor deserving agents, loans from the Sassoon David Trust Fund are made available at normal interest of 2 per cent.

Before the supply of a breeding bull is made, the village in question is carefully surveyed in respect of cattle keeping and care; storage of fodder and grazing facilities available, willingness of the villagers to castrate scrub bulls in the village. Besides the agent is required to send monthly service record of the Premium Bulls to Inspectors of Cattle Breeding together with the report of the condition of the bull. Generally the Premium Bulls are inspected quarterly by the Inspectors of Cattle Breeding. The number of Premium Bulls working in different division is shown below :—

Name of Division.	Premium bulls working.		Remarks.
	1st July 1939.	1st July 1940.	
South Central	75	136	
North Central	66	72	
Southern	62	76	
Northern	54	31*	*Less due to famine conditions.
Palghar (Bombay Suburban) ..	21	21	
Total ..	278	336	

Besides there were 71 Premium Bulls working part-time whose terms expired before 1st July 1940. During the year 102 new bulls were supplied. Out of these 80 bulls were the progeny of the Premium Bulls.

(*b*) *His Excellency the Viceroy's Gift Bull Scheme.*—Early in December 1939 the operation of the Gift Bull Scheme which was so far under the charge of territorial Deputy Directors of Agriculture, was transferred under the control of the Livestock Section. This involved additional work to the District staff. A complete survey of the position in regard to the bulls issued is being taken up. This survey would reveal which bulls are being properly looked after and which are neglected. Since the operation of the scheme (July 1936) 296 bulls have been located so far under this scheme during the last four years. Out of these bulls, 25 bulls have died and 83 bulls have their periods expired thus leaving 188 bulls. The location of the Gift Bulls while respecting the wishes of the donors was done on the following conditions.

(1) If the agent agrees to mainain the bulls for 3 years at his own cost the bull becomes the property of the agents.

or

(2) If the agent receives maintenance charges, the bull would be the property of Government.

(*c*) *Working of the Cow Premium Scheme.*—It has been our experience that the poor classes take good care of cows if these are supplied to them free on conditions of breeding. Generally such cows are located in villages having Premium Bulls. During the year, with the help of respective Village Improvement Committees, the following number of Premium cows were located :—

25 Khillar Heifers in Man, Khatav and Koregaon talukas of Satara District.

15 Nimar cows and 5 Nimar Heifers } in Jalgaon, Bhusawal and Raver talukas of East Khandesh.

20 Kankrej cows in the Panch Mahals.

65

Registration of Animals.—The number of pure-bred stock registered during the year was 1,429. The following table gives the registration of pure bred stock up-to-date :—

Division.	Number of animals registered up to June 1939.	Number of animals registered during 1939-40.	Total up to the end of June 1940.
Northern	890	....	890
Palghar	678	281	959
North Central	510	296	806
South Central	1,240	529	1,769
Southern	782	323	1,105
	4,100	1,429	5,529

Application of the Livestock Improvement Act of 1933.—The Bombay Livestock Improvement Act of 1933, has so far been applied to 77 villages as shown below :—

Name of District.	Number of villages.	Date when application of the Act was gazetted.
East Khandesh	2	24th July 1936.
Dharwar	27	31st May 1937.
Sholapur	12	8th January 1938.
West Khandesh	6	30th March 1939.
Ahmedabad	23	15th July 1939.
East Khandesh	7	14th November 1939.
Total ..	77	

The effect of the application of the Act is very marked especially in connection with the better quality of young stock produced by the village herds which are freed from the menance of the undesirable "scrub bulls" on the village grazing areas. In 35 villages where the Act has been applied, 1,068 castrations of scrub bulls were done during the year, with the help of the Assistant Veterinary Surgeons. The remaining villages are being taken up for the purpose. The Act has worked satisfactorily on the whole with the co-operation of the villages concerned.

(*g*) *Poultry Improvement in villages.*—This is dealt with separately in this report.

(*h*) *Improvement of the Milch Buffalo.*—According to the scheme sanctioned last year 7 Surti buffalo bull calves produced at the Agricultural College Dairy, Kirkee, have been placed with the Vaghris in Mehamadabad and Matar Taluka of Kaira District for the purpose of rearing and subsequent issue as premium bulls.

Two buffalo bulls from the Bankapur Cattle Breeding Farm were supplied during the year in the Southern Division. The total number of Buffalo breeding bulls working during the year were 29 :—

(*i*) Premium Bulls	16
(*ii*) Gift Bulls	13
Total ..	29

Cattle Shows, Rallies and Demonstrations.—Cheap Cattle Shows, Rallies and Demonstrations play a very important part in the propaganda of Livestock Improvement work. During the year under review 34 cheap cattle shows, 2 cattle rallies were held as against 13 and 8 of the previous year. Twenty-seven Demonstrations of the working of the cream separators were shown to demonstrate the superiority of the cream separator method over the local method of making butter and ghee. Besides 5 silage making demonstrations were organised. The most important of the Shows was one held at Khandala in Alibag Taluka in January 1940 when His Excellency the Viceroy of India (Lord Linglithgow) graced the occasion.

One more activity in connection with the cattle shows undertaken by this section needs mentioning. It is the part this Province has played in sending cattle of different breeds to the Third All-India Cattle Show held in New Delhi in February 1940, to demonstrate what is being done in this Province. The number of cattle of different breeds sent and prizes won are shown in the appendix I attached herewith.

(*i*) *Feeding Trials*—(*a*) *Anjan leaves.*—At the request of the Chief Conservator of Forests, Bombay Province, Poona, a practical trial of feeding Anjan leaves was undertaken at Borvihir village in Dhulia Taluka, West Khandesh for a period of 40 days, with the co-operation of the village people. Twelve buffaloes were selected for the purpose. The trial was divided into five periods of 8 days each. Anjan leaves were fed at the rate of 15 lbs. during the first period and increasing the quantity by 5 lbs. per period till the quantity of leaves fed during the last period was 35 lbs. per buffalo per day. This short trial has shown that milch buffaloes like the leaves very much and their milk yield were steadily maintained in spite of the advancing lactation. In some cases the milk yield increased.

(*b*) *Tivir leaves.*—(Avicennia alba)—The Tivir is a salt bushy plant found abundantly in creeks of Thana and Bombay Suburban Districts. This bush is otherwise called " Khoti " by the people. A short feeding trial of one week was undertaken in April 1940 at Turumbha near Thana on 3 buffaloes and 2 cows with the co-operation of the people. The buffaloes were given three times a day 65 lbs. of Tivir leaves and 5 lbs. of hay while the cows were given 40 lbs. of leaves and 4 lbs. of hay. The actual quantities of leaves eaten per day were 32 to 35 lbs. by the buffaloes and 13 to 20 lbs. by the cows. The idea underlying the trial was to find out whether the cattle eat the leaves and how much and whether the leaves could be used in scarcity periods.

(*j*) *Acquainting District Social workers with the work done by this Section.*—All of my staff endeavoured to their best in making acquaintenance with District Social workers and leaders, acquainting them with the work done by this section.

General.—I would here like to bring to your notice that I am very much satisfied with the work of my entire staff, they have all worked

very willingly during a year of heavy work. I would particularly like to mention the following who have done outstanding work (1) Mr. Y. K. Phadke, Head Clerk, (2) Mr. S. S. Khot, Manager, Sheep Breeding Farm, (3) Mr. S. K. Angdi, Manager, Cattle Breeding Farm, Bankapur, (4) Mr. V. C. Charanti, Manager, Poultry Farm, Kirkee, and last but not least the very valuable assistance given me by Mr. D. B. Kolhe, Assistant Livestock Expert to Government.

Report of Expert Cattle Committee.

This Committee was appointed by Government of Bombay as per G. R., R. D., No. 8409/33, dated 10th April 1939 to give final shape to schemes for cattle improvement in the Bombay Province. The Committee examined the matter under the following sections :—

(*i*) Cattle Breeds of the Bombay Province.

(*ii*) Scheme for the establishment of co-operative organisation for cattle breeding and milk production in the Bombay Province.

(*iii*) General recommendations with regard to future policy of Government in cattle breeding.

(*iv*) Official and Non-official Institutions engaged in cattle breeding in the Bombay Province.

(*v*) Prevention of slaughter of milch animals.

(*vi*) Skim milk powder industry.

(*vii*) Control of cattle diseases.

The significance of this Expert Cattle Committee's report is seen from the recommendations of the Sub-committee on Animal Husbandry and Dairying of the Indian National Planning Committee to adopt this report as the basis of work mutatis mutandis in other Provinces and States in India.

Northcote Cattle Breeding Farm, Chharodi.

Personnel.—Mr. B. B. Jamaspjina held charge as Manager of the farm throughout the year. For more than eight months there was no Clerk since the permanent one was transferred to the office of the Director of Agriculture, Poona. Consequently the extra work had to be done by the Manager and his Sub-overseer Mr. M. S. Patel. I am glad to record my high appreciation of their willingly shouldering the extra burden.

Season.—The monsoon season during the year 1939-40 was perhaps the worst in the agricultural years for the last two decades. The season was poor and very erratic. It rained in one lot of 1 inch and 79 cents in July, and in another lot of 15½ inches within 9 days in the last week of

August and the first week of September, after a complete break of nearly 5 weeks. In one day on 28th August there was 8½" of rainfall. For about 15 days the farm was a huge lake. There were no late rains after September. This is the fifth year in succession when the late rains have failed completely. The total rainfall was 16"–43 cents as against 27"–57 cents of the previous year. Thus the season caused shortage of fodder to an extent that the farm never experienced for the last two decades. There was nothing by way of grazing nor storage of Kadbi anywhere in the district, particularly in the Sanand and Viramgam talukas. The winter season was not very severe except for a week and the Spring was normal.

Cultivation of fodder crops.—With the advent of the first rains, all fields were sown, but it was soon realised that the effort was in vain. Most of the plots except those of Bajri failed completely due to a long break of 5 weeks. Second sowing was taken up again after the continuous rains of August-September. Since there was no rain afterwards the second sowing proved almost a failure. Jowar failed completely in 26 acres and partially failed in about as many acres. Nearly 20 acres of land could not be sown as it could not be reached and the soil caked on the top afterwards.

Irrigated crops, however, did well. Berseem yielded 57,834 lbs. per acre in four cuttings. Oats and Peas yielded 28,984 lbs. per acre in two cuttings, while maize yielded 14,245 lbs. In spite of the bad year, the farm was successful in growing Napier grass. Out of 6 samples of seeds sent by the Economic Botanist two have grown and are being multiplied, viz.—

(*i*) Chloris gayana.

(*ii*) Paspalum dilatatum.

Silage Making.—All available sources of green grass were tapped to make as much silage as possible looking to the failure of the crops and grasses. Only three tower silo pits could be filled with 1,35,436 lbs. of green grass at a total cost of Rs. 447 or Rs. 3-4-8 per 1,000 lbs.

Hay Making.—Due to the policy laid down to store two year's stock of hay and also such stock as would be required for the Institute of Agriculture, Anand, all possible hay areas were carefully saved and mowed. But due to the failure of the Monsoons, only 2,09,088 lbs. of hay was made as against 9,91,735 lbs. during the previous year. The hay was mere sticks, with no leaves but it was of the best kind. The cost of making and stacking hay was Rs. 3-3-1 per 1,000 lbs.

Before this hay-making was possible, a very severe famine was facing the farm and it was a question if cattle could be saved. Hence negotiations were started with the Collector of Ahmedabad to give the farm hay out of the stock, belonging to the Contractor, which was detained. Thus a stack containing 5,62,742 lbs. of hay at a total cost of Rs. 11,860-13-6 was purchased by the Collector out of his funds and afterwards the whole stock was transferred to the farm under orders of Government.

Livestock.—The strength of the herd stood as under during the year under report :—

	Opening.	Closing.
Stud Bull	11	9
Cows	113	118
Heifers over one year	72	132
Female yearlings	89	43
Young bulls over one year	20	61
Male yearlings	58	23
Bullocks	62	56
Buffalo Bulls	13	4
Outside Premium and Gift Bulls	....	4
Total ..	438	450

The increase was due to receiving of animals as a gift from the Regent Rani Saheba of Patdi State and 9 animals received back from the Vocational Training School, Godhra. It may be noted that in the breeding herd the female stock is nearly 76 per cent. which is very desirable. 18 new heifers calved during the year as against 28 of the previous year. As regards their milking capacity, 7 have proved good, 7 have been fair and 3 were bad. 5 of the second group have since then been disposed of and out of the poor lot one died and one was sold.

Among the 18 new heifers that have calved 4 have been from the Surat herd and one Gift heifer from Patdi State. There were in all 82 births during the year—50 females and 32 males as against 53 females and 47 males during the previous year.

Breeding Policy.—The breeding policy adopted on the farm is to produce an economical animal with the desired breed charactertistics. Thus we have foremost in our mind the important characteristics of (1) early maturity, (2) regularity in calving, and (3) the desired type. During the year, as noted above, 18 new heifers have calved. Out of these two home-bred heifers calved at the age of 3 years and 1½ months. The effect of different breeding bulls in the transmission of the character of "early maturity" to these heifers as compared to their dams is shown in the statement appended herewith (Appendix A).

Similarly the progressive improvement brought about by all bulls since 1917 in respect of transmission of this character, i.e. early maturity is also appended herewith (Appendix B).

Milk Production.—Almost all the cows and heifers that calved during the year, yielded at the pail. A few, however, had to be left to suckle their calves after a short period when they were found to be poor milkers. The total annual production of milk was 1,78,688¼ lbs. as against 1,47,517¾ lbs. during the preceeding year. The number of cows that produced this milk was 122 as against 118 during the last year. The average milk yield per cow of the herd works out 1,517 lbs. and 15 ozs. as against 1,485 lbs. and 8 ozs. of the last year. The classification of the milking herd during the year was as under :—.

	Percentage of the total milked. Per cent.
20 cows yielded over 3,000 lbs.	16
33 cows yielded over 2,000 lbs.	28
21 cows yielded over 1,500 lbs.	17
31 cows yielded below 1,500 lbs.	25
17 cows still milking and not finished their lactation yield	14
Total 122	100

Thus over 44 per cent of cows have yielded over 2,000 lbs. of milk which is remarkable achievement. The highest milk yield was from one cow "Chanothi 6-34" yielding 5,808¾ lbs. in her second lactation.

Breeding Bulls issued.—Eleven bulls were issued during the year of which one was a buffalo bull. Out of these 4 were on the Premium System and 7 were for the Gift Bull Scheme. Besides 9 buffalo bulls were issued during the year in Ahmedabad and Broach districts.

Sales.—The total number of animals sold or issued during the year was 73 at a total realisation of Rs. 2,858. Baroda State purchased 4 breeding bulls, 10 cows and 10 young bull calves for their newly established Cattle Breeding Farm at Khoraj as a foundation stock.

Cattle Received.—The Regent Rani Saheba of Patdi State donated to the farm 3 cows, 2 heifers and one male calf of the Kankrej breed during the year under report. Two Gift bulls from Borsad taluka were returned as "not serving"—one was exceedingly debilitated and made incurably lame and therefore it was sent away to the Panjrapole. 4 cows, 2 bulls, 2 male calves and 2 female calves which were sold to the Vocational School, Godhra, were received back as they were not wanted. Due to the extreme famine conditions, 5 bulls were received back at the farm from the agents who were unable to feed them. Thus the total number of animals received during the year was 22.

Diseases and Deaths.—Although the year was bad from grazing point of view, it was conspicuous by the absence of any epidemic disease. In spite of the shortage of fodder and grazing, the condition of the animal was good. There were 18 deaths during the year, of these 10 were calves up to 6 months which died of minor ailments. Four cows died of traumatic pericarditis and pneumonitis.

General.—Government sanctioned the transfer of the Northcote Cattle Farm, Chharodi, to the Institute of Agriculture, Animal Husbandry and Dairying, Anand, District Kaira with effect from 1st April 1940 as per G. R., R. D., No. 7243/33, dated 30th March 1940. Orders regarding the transfer of the staff at the Chharodi Farm to the Institute on Foreign Service conditions were issued as per G. R., R. D., No. 7243/33 of 9th July 1940.

APPENDIX A

Statement showing Age, at first calving of the Heifers that calved during 1939-40 as compared with their Dams, at the Chharodi Farm.

Serial No.	Daughters.						Dams.					
	Name.	Brand Number and Date of Birth.	Sire.	Age at first calving.			Name of Dam.	Brand Number and Date of birth.	Sire.	Age at first calving.		
				Y.	M.	D.				Y.	M.	D.
1	Irravi	5 24th February 1935.	Ravishankar.	4	1	7	Iravati ..	101/5 6th November 1920.	Mohan ..	4	1	24
2	Amravi	13 20th November 1934	Do.	4	5	6	Anmata ..	1st March 1927.	Agakhan ..	4	10	22
				8	6	13				9	0	16
			Average ..	4	3	6			Average ..	4	6	8
3	Lili ..	5 9th February 1935.	Nasal ..	4	1	27	Lili ..	26 27th October 1927.	Todar ..	4	6	5
4	Rozi ..	10 30th May 1936.	3-29 Nasal ..	3	1	11	Rozi ..	9 30th April 1931.	Pasvo ..	3	7	30
				7	3	8				8	2	5
			Average ..	3	7	19			Average ..	4	1	3
5	Samli ..	1 26th January 1935.	Ravti ..	4	2	11	Samli ..	24 29th October 1928.	Kachari ..	4	3	14
6	Gomti ..	2 26th January 1935.	30-29 Ravti ..	4	2	18	Gomti ..	3 3rd March 1931.	8-25 Bhotu ..	3	10	23
7	Bhotu ..	9 5th March 1935.	Ravti ..	4	1	17	Bhotu ..	1 19th February 1928.	41-25 Todar ..	4	3	0
8	Chokhli ..	4 24th January 1936.	Ravti ..	3	1	11	Chokhli ..	5 22nd Feb. 1932.	Kesar ..	3	11	2
9	Bhotu ..	13 2nd April 1935.	Ravti ..	4	8	14	Bhotu ..	2 5th January 1932.	6-28 Kesar ..	3	2	27
				20	4	11			6-28	19	7	6
			Average	4	0	26			Average ..	3	11	1

APPENDIX A—contd.

Serial No.	Daughters.						Dams.					
	Name.	Brand Number Date of Birth	Sire.	Age at first calving.			Name of Dam.	Brand Number and Date of birth.	Sire.	Age at first calving.		
				Y.	M.	D.				Y.	M.	D.
		15						9				
10	Lilor ..	16th February 1934.	Meghan ..	4	4	9	Lilor ..	25th January 1922.	Mohan ..	4	0	1
		12	15-29					7				
11	Chandlee ..	1st April 1935.	Meghan ..	4	1	19	Chandlee ..	17th February 1927.	Do. ..	4	4	1
		24						14				
12	Santu ..	11th November 1935	Do. ..	3	9	22	Santu ..	18th February 1930.	Pasvo ..	3	6	0
		14						1				
13	Chanothi ..	14th April 1935.	Do. ..	4	6	25	Chanothi ..	30th January 1924.	Mohan ..	3	0	21
				16	10	15				14	10	23
			Average ..	4	2	19			Average ..	3	8	21
		10						123/87				
14	Anspi ..	7th June 1934.	Polo ..	4	11	19	Ansli ..	6th February 1923.	Kevdo ..	4	11	22
		14						155/5				
15	Aspoli ..	23rd November 1934.	Do. ..	4	8	5	Asmani ..	27th October 1923.	Do. ..	4	4	2
				9	7	24				9	3	24
			Average ..	4	9	27			Average ..	4	7	27

APPENDIX A—contd.

Serial No.	Daughters.				Dams.			
	Name.	Brand Number Date of Birth.	Sire.	Age at first calving.	Name of Dam.	Brand Number and Date of birth.	Sire.	Age at first calving.
				Y. M. D.				Y. M. D.
16	Medhi ..	26 21st November 1935	Kachari .. 18 31	3 7 13	Medhi ..	12 29th June 1932.	Chandlee .. 20/28	3 4 22
17	Nasal ..	15 18th April 1935.	Nasal ..	4 8 18	Nasal ..	36 22nd October 1926.	Mohan ..	3 7 19
18	Dali Gift animal.	31 1935	..	4½ Years ..	Margu	.....	....	....

APPENDIX-B.

Statement showing the effect of Sires on "Early Maturity" in their daughters as compared with their Dams from 1917 to 1940, at the Chharodi Farm.

Serial No.	Name of Sire.	Number of daughters.	Average age at first calving of		Improvement in early maturity over Dam.
			Daughters.	Dams.	
1	2	3	4		5
			Y. M.	Y. M.	Y. M.
1	Mohan	53	4 1½	5 5	1 3½
2	Kachari of 1911 ..	12	4 6½	5 8	1 1½
3	Nawale	8	5 4	5 6½	0 2½
4	Sultan	8	4 11½	5 4½	0 5
5	Chitram	26	4 5½	5 9½	1 4
6	Moti	3	4 10½	4 11½	0 ¾
7	Vadli	3	4 10	4 11½	0 1½
8	Kanudo	9	4 1½	5 8½	1 6½
9	Senduri	6	3 11½	5 5	1 5½
10	Bhim	27	3 11¾	5 3	1 3¼
11	Resham	3	3 11½	5 1	1 1½
12	Faterio	6	4 3¾	5 8½	1 4¾
13	Kevdo	2	4 3	4 10	0 7
14	Bhuri	2	4 11	5 ¾	0 1¾
15	Bhotu 2-1924 ..	1	4 2	4 1¾	0 ¼
16	Todar	18	4 3½	4 10¼	0 6¾

APPENDIX B—contd.

Serial No.	Name of Sire.	Number of daughters.	Avarage age at first calving of		Improvement in early maturity over Dams.
			Daughters.	Dams.	
1	2	3	4		5
			Y. M.	Y. M.	Y. M.
17	Farsi	3	4 2½	4 ¼	0 2
18	Kachari 8-1925 ..	9	3 11¼	4 4¼	0 4¾
19	Renchhi ..	10	3 10	4 7¼	0 9¼
20	Bhotu 41-25 ..	7	3 9½	4 6¼	0 9
21	Pasuo	4	3 5½	4 8¼	1 2¾
22	Kesur 6-28 ..	6	4 0	4 1¼	0 1¼
23	Chandilee 20-28 ..	12	4 ¾	4 5½	0 4¾
24	Waghen 12-28 ..	4	4 2½	4 1¼	0 1¼
25	Pudo 8-29 ..	6	3 10	4 4	0 6
26	Meghan 15-29 ..	10	3 11¼	3 10¾	0 ½
27	Ujol 11-31 ..	6	3 11½	4 3¼	0 3¾
28	Nasul 3-29 ..	8	3 7¼	4 3¾	0 8½
29	Ravti 30-29 ..	20	4 ¼	4 2½	0 2¼
30	Nasul 22-30 ..	2	4 2¾	3 6¾	0 8
31	Vanar 2-27 ..	2	3 9	3 9½	0 ½
32	Kachari 18-31 ..	1	3 7½	3 4¾	0 2¾
33	Ravishankar ..	2	4 3¼	4 6¼	0 3
34	Polo	2	4 9¾	4 7¾	0 2

Cattle Breeding Farm, Bankapur.

Personnel.—Mr. S. K. Angdi held charge of the farm throughout the year.

Season.—Anti-Monsoon rains totalling 2″-69 cents were useful in preparatory tillage. The sowing of Kharif crops started in the middle of June and were over by the first week of July. During the months of July and August there was regular rainfall and consequently the Kharif crops made very healthy and promising growth. There was a long break in the month of September which gave a setback to the crops. In the month of October there was timely rainfall of about 5″ and this helped to revive the crops. The total rainfall during the year was 27″-31 cents as against 26″ and 60 cents of the previous year.

Livestock.—The year opened with 124 heads of cattle and closed with 127 as shown below :—

	Opening 1st July 1939.	Closing 30th June 1940.
Stud bulls	3	2
Cows	36	38
Heifers	29	30
Young bulls	19	13
Cow calves	17	17
Bull calves	12	20
Bullocks	8	7
Total ..	124	127

During the year under report one Amrit Mahal bull was purchased from Mysore State at a cost of Rs. 450 for the introduction of new blood.

Breeding policy and performance of the herd.—The breeding policy aims at (1) early maturity (2) regularity in breeding and (3) characteristic type and confirmation of the Amrit Mahal breed.

During the year 10 heifers calved for the first time, out of these, 6 calved between the ages of 3 to 3½ years and 4 between 3½ to 4 years. There were 39 calves—21 male and 18 female born during the year as against 32—11 male and 21 female calves of the last year. As regards regularity of calving, more than ⅔rd of the cows that calved during the year have the interval between two calvings between 11 to 16 months (*vide* Appendix II attached).

Breeding Bulls supplied.—The farm supplied 9 farm bred bulls during the year as against 13 of the last year.

Services to outside cows.—In addition to the services rendered by the bulls to farm cows, 40 outside cows of cultivators of surrounding villages got the benefit of services of the farm bulls. The receipts were credited.

Disease and mortality.—Foot and Mouth appeared on the Farm in June. There was no other epidemic on the farm. Preventive inoculation against H. S. and Black Quarter were carried out as usual during the year. There were 3 casualties among the cattle as against 7 of the last year.

Cultivation of fodder crops.—The total area under cultivation was 30 acres divided into 10 plots. The total cropped area during the year was 45 acres—30 gunthas of which $\frac{2}{3}$rd was under Kharif and $\frac{1}{3}$rd under Rabi. The total fodder production was 6,93,796 lbs. of green fodder, 66,500 lbs. of dry and 8,630 lbs. of seeds.

The average yields of different fodder crops grown on the farm together with the cost of production per acre are shown in Appendix III attached herewith.

Maiz mixed with chavali as kharif crop.—The area under maize cultivation was 15 acres 10 gunthas. This is grown mostly for silage purposes. The crop was harvested in September yielding 4,48,915 lbs. of green fodder, yielding about 29,437 lbs. of green maize fodder per acre. Of this 3,73,315 lbs. of fodder was turned in silage and 75,600 lbs. was fed to cattle. Besides 1,710 lbs. of maize seed were obtained from about one acre.

Jowar mixed with Chavli.—This crop occupied eight acres and twenty gunthas and was harvested from 11th October 1939 to 20th January 1940. The crop furnished 90,624 lbs. of green fodder, 44,500 lbs. of dry fodder and 2,800 lbs. of grains for seed purposes.

Ragi.—This crop was grown on 3 acres 10 gunthas for ensilage. The yield was 46,532 lbs. of green fodder.

Soya beans (*Large yellow*).—This was grown only 20 gunthas of land for seed purposes. The yields of grain was 520 lbs. and chaff 300 lbs.

Chavli.—This covered 2 acres of land and yielded 23,320 lbs. of green fodder.

Maize (*Rabi crop*).—This was grown on an area of 2 acres to take advantage of the late rains to supplement the fodder. The crop yielded 23,060 lbs. of fodder.

Kulthi (*Rabi crop*).—This is the main pulse crop grown as Rabi crop following the Kharif harvest. It was grown on 8 acres and 30

gunthas as against 4 acres of the last year. The crop was harvested from 28th November 1939 to 1st March 1940. The crop yielded 21,150 lbs. of green fodder, 9,700 lbs. of chaff and 3,300 lbs. of seeds.

Matki (Rabi crop).—This covered 5 acres as a second crop after Kharif maize. The crop was harvested from 5th December 1939 to 29th January 1940. The yields were 13,800 lbs. green fodder, 400 chaff and 178 lbs. of seeds.

Elephanta and Guinea grass.—This occupied 25 gunthas and gave 5 cuttings yielding 28,269 lbs. of green fodder.

Lucerne.—This covered 5 gunthas of land and yielded 3,112 lbs. in 10 cuttings.

Napier grass.—This was grown on 10 gunthas of land and yielded 1,955 lbs. of grass in 4 cuttings.

Silage and Hay making.—There are six round underground katcha silo pits on the farm and all were filled during the year. The total quantity of green fodder put in the silo pits was 5,88,340 lbs. as against 5,02,382 lbs. of the previous year. The principal grasses on the farm are :—

1. Andropogan contortus.
2. Apluda-varia.
3. Anthisteria-ciliata.
4. Ischimum-Laxum.

During the year, 2,73,372 lbs. of green grass was obtained as against 3,19,175 lbs. of the preceding year. 87,380 lbs. of green grass was turned into silage as against 1,07,455 lbs. of the last year. The remaining quantity was fed green to the cattle. 50,000 lbs. of grass was prepared from an area of 20 acres at a total cost of Rs. 98-4-0 i.e., Rs. 1-10-11 per 1,000 lbs. of hay. From the Kalasgeri grass area, 25,505 lbs. of hay was obtained and carted to the farm. The remaining areas were grazed by the farm dry cattle.

Tegur Cattle Breeding Farm.

At the meeting of the officers of the Agricultural Department held at Poona in March 1939 to review the research work of the Agricultural Department and to formulate proposals for its intensification and expansion, it was decided to recommend to Government that the Tegur Cattle Farm should be reorganised in order to establish thereon small breeding herds of Dangi and Nimar cattle under the Livestock Expert to Government. It was realised that the two draught breeds mentioned above have, up till now, received no attention from Government in the direction of scientific improvement and that such work could adequately be done at Tegur. In the past, the farm, from the cattle breeding point

of view was used for grading up local cattle by the use of good breeding bulls of the Amrit Mahal type and was devoted to bullock production. It was realised that this work could and was being undertaken in villages.

Accordingly, in May 1939, a scheme for the reorganisation of the Tegur Cattel Farm and its continuance as a nucleus for the establishment of small herds of Dangi and Nimar cattle (each herd consisting of 10 cows and 2 breeding bulls) for the production of suitable dual purpose cattle was submitted and sanctioned as per Government Resolution, Revenue Department, No. 8418/33, dated 14th May 1940.

The farm was transferred to the control of the Livestock Expert to Government from 1st November 1939. The graded herd of Amrit Mahal cattle was disposed of during the year by public auction on 28th October 1939, retaining 3 pairs of working bullocks for the use of the farm.

Personnel.—Mr. G. A. Saundatti, Agricultural Sub-overseer was in charge of the Farm. Mr. A. B. Gadagkar, Divisional Inspector of Cattle Breeding, Southern Division, Dharwar, supervised the working of the farm.

61,000 lbs. of green grass was ensilaged and 30,000 lbs. of hay was made to make provision for the next year. Fifteen acres of jowar and 15 acres of kulthi were harvested and stored for the feeding of bullocks. Thirty acres of land was ploughed and kept ready for growing of fodder crops for the next season.

The Director of Agriculture paid a visit to the farm on 9th June 1940 and approved of the plans and estimates for the following structures for the farm :—

	Rs.
(1) Erection of one cattle byre	2,500
(2) Alteration to existing quarters	3,000
(3) Fencing	750
(4) Completion of cattle dip	250

As for the purchase of foundation stock of cattle, these will be purchased in September 1940. Two pedigree Nimar bulls have been earmarked from the Pimple Cattle Breeding Farm, Jalgaon, East Khandesh.

Government Central Poultry Farm, Kirkee.

Personnel.—Mr. V. C. Charanti held charge of the Farm throughout the year. The post of the Assistant Manager was confirmed during the year as per Government Resolution, Revenue Department, No. 9487-A /33, dated 24th August 1939.

The following buildings were constructed for the use of the Farm during this year.

One Store-room measuring 32′ × 15′ × 13′ at a total cost of Rs. 918.

Two rooms measuring 24′ × 13′ × 11¾′ were built at a total cost of Rs. 586 on the premises of the Agricultural College Dairy, Kirkee. These rooms were transferred to the Agricultural College Dairy in exchange of the rooms standing on the premises of the farm.

Strength of the flock.—There were 1,207 fowls and 45 turkeys on 30th June 1940 as against 821 fowls of the last year. The health of the flock was good throughout the year.

The total mortality during the year was 76 adults and 92 chickens, i.e., only 8·27 per cent. on the average strength of the flock. This was mostly due to minor ailments.

Testing pen record.—Eighteen White Leghorn, 6 Rhode Island Red, 6 White Wyandotte and 6 Australorp pullets were selected for testing the egg laying capacity in the single testing pens from 16th November 1939. This trial will continue up to 15th November 1940. The testing pen results calculated on an average of the past 7½ months record are as under:—

	Average No. of eggs per bird per year.
White Leghorn	206
White Wyandotte	224
Rhode Island Red	237
Australorp	157

Details of this trial will be found in Appendix IV attached herewith.

Incubation.—Artificial incubation was started on 30th August 1939 and it was stopped on 21st May 1940. During that period 1,210 chicks were hatched. The hatching percentage of artificial incubation was 76·09 as against 74·44 of the previous year. The average cost of hatching a chick was one anna and one and a quarter pie (*vide* Appendices V and VI attached herewith).

Supply of birds for breeding purposes.—Three hundred and ninety-three birds were sold to the cultivators at concession rates for Rs. 1,431-4-0 and 207 birds were sold to rich people at full rates for Rs. 1,382-8-0 during the year under report.

Four hundred and eighty-nine setting eggs were sold at concession rates to the farmers for Rs. 123-4-3 and 358 setting eggs were sold at full rates to the well-to-do people for Rs. 216-2-9 during this year.

Poultry Training.—Each of the District School Boards, West Khandesh and Thana, deputed one teacher for the practical poultry training class during the year under review. Fifty-three students joined the Poultry Training Class at the Government Central Poultry Farm, Kirkee. Out of these 47 students completed the course and 40 students who successfully went through the course were awarded certificates. Nine students who stood high were awarded prizes worth Rs. 270.

Four Portable Poultry houses were constructed by the students in the Farm Workshop on receipt of requisition from the Poultry farmers.

Turkey breeding Experiment.—Turkey breeding was started on this Farm on 1st April 1940 with a view to supply the setting eggs and table birds to the surrounding people. There is a good demand for table turkey eggs.

Turkey management.—Hatching, rearing, feeding, etc., was found to be as successful as Poultry management. The only difficulty we experienced in rearing turkey chickens was chicken pox. The turkey chickens get this pox when they are 3-4 months old. The only remedy to overcome this was to practise preventive measures. Turkeys do not thrive well in confinement and need free range. They relish greens well and do better on green grazing. Fifty-three turkey chickens were hatched during the year under report and these are all doing very well.

Finance.—	Rs. a. p.
(1) The total expenditure of the farm including the pay of establishment, construction of buildings, etc.	5,896 2 9
(2) The total receipts of the farm ..	5,097 15 6

Government Poultry Farm, Dhulia.

This Poultry Farm was established (as per scheme sanctioned by Government during the year) to serve as a training centre for farmers in Poultry keeping by converting the poultry centre at the Dhulia Agricultural School into a full-fledged poultry farm. An area of 3 acres and 10 gunthas was made available from the Agricultural School for the establishment of the institute.

Personnel.—Mr. B. P. Salunke, an Agricultural Sub-Overseer attached to the Agricultural School, was transferred as Manager of the new Poultry Farm from 1st March 1940 and held charge of the Farm since then.

Poultry structures.—The following poultry structures were erected during the year at the cost shown against each item :—

(1) Poultry Houses and Runs :—	Rs. a. p.
(*a*) Two breeding pens 40′ × 80′ each with a permanent roosting house 15′ × 10′ in the centre. (*b*) Four chicken pens 16′ × 10′ each with a portable roosting house 4′ × 3′ in each pen.	2,003 15 10
(2) One incubator and brooder room	1,599 0 0
(3) Quarters for the Manager	1,528 9 0

Equipment.—Necessary Poultry Farm equipment worth Rs. 194-10-0 was transferred from the school to the new farm. New equipment worth Rs. 346 was purchased during the year.

Poultry stock.—The following stock was received from the Agricultural School:—

(1) Rhode Island Red cock	..	..	1
(2) Rhode Island Red hens	..	..	5
(3) White Leghorn cocks	..	..	4
(4) White Leghorn hens	..	..	19
(5) White Leghorn chickens	..	..	54
(6) Rhode Island Red chickens	..	..	30
			113

Besides pedigree stock of 5 hens and 1 cock of each, the White Leghorn and the Rhode Island Red breed were supplied to the farm from the Government Central Poultry Farm, Kirkee, for the foundation stock.

Health.—The health of the stock was good. Twelve chickens succumbed to the intense heat on 24th April 1940 when the thermometer registered 112F°.

Training.—Fifteen applications were received from the students for a poultry training course, out of which eight students joined the course commencing from 1st July 1940. First year students of the Agricultural School, Dhulia, are given instructions in Poultry Farming by the Farm Manager.

General.—Hatching of eggs could not be undertaken due to advanced season, when the farm was started. This will be carried out during the coming hatching season, October to January. Owing to the intense heat it is desirable that chickens should be well advanced before the real hot weather sets in.

Government Poultry Farm, Dharwar.

The Government Poultry Farm, Dharwar, was established (as per scheme sanctioned by Government during the year) to serve as a training centre for farmers in Poultry keeping by converting the poultry centre at the Dharwar Agricultural Farm into a full Poultry Farm. An area of 2 acres and 10 gunthas was made available from the Agricultural Farm, Dharwar, for the establishment of the Poultry Farm.

Personnel.—Mr. P. S. Inamdar, the Agricultural Sub-Overseer attached to the Dharwar Agricultural Farm, was transferred as Manager of the new Poultry Farm from 23rd October 1939 and held charge of the farm since then.

Poultry structures.—The following poultry structures were erected during the year under report at the cost shown against them :—

	Rs.	a.	p.
(1) Poultry Houses and Runs :—			
(*a*) Four breeding pens 20′ × 80′ each with two permanent roosting houses 7′ × 15′ × 7 6′ each, one house in the centre of two breeding pens. (*b*) Four chicken yards 20′ × 10′ each with portable roosting houses 4′ × 3′ × 2½′ in each pen.	2,038	15	4
(2) Incubator, brooder and office rooms ..	1,790	0	0
	3,828	15	4

Equipment.—Poultry Farm equipment worth Rs. 420 was transferred from the poultry section of the Agricultural Farm to the new Poultry Farm. New poultry equipment worth Rs. 451 were purchased during the year.

Poultry stock.—The following stock was transferred from the Agricultural Farm :—

	White Leghorn.	Rhode Island Red.
Cocks	1	3
Hens	4	2
Cockerels	5	8
Pullets	10	8
Chicks	8	28
	28	49
Total number of fowls transferred ..	77	

The White Leghorn hens laid on an average 116 eggs per bird per year while the Rhode Island Red hens laid 129 eggs during the year.

Besides pedigree stock 6 hens and 2 cocks, 5 hens and 2 cocks of White Leghorn and Rhode Island Red breed respectively was supplied to the farm from the Government Central Poultry Farm, Kirkee (Poona), for the introduction of new blood on the farm.

Incubation.—85 chicks were hatched during the period of from 23rd October 1939 to the end of February 1940.

Health.—The health of the stock in general was normal. There were 28 deaths during the year under review. The common diseases found on the farm are Diarrhoea and Worms, and the Epidemics fowl cholera and chicken pox were noticed. Preventive measures were adopted in consultation with the local Veterinary Assistant Surgeon to stay the disease from spreading. The new Farm is located in a clear area and should help in preventing disease.

Poultry Training.—This has not been undertaken during the year under report as there is no accommodation for the students and for a class room. The same will be taken up during next year.

General.—During the year under report 24 fowls were sold for Rs. 56-2-0 only and 527 eggs both for table and hatching were sold for Rs. 22-11-6.

Poultry Improvement Schemes.

Two schemes for the improvement of Poultry were in progress during this year. These schemes are :—

(*i*) Scheme for the improvement of poultry in villages.

(*ii*) Scheme for the encouragement of Pedigree Poultry Keeping in villages by grant of Premia to poultry farmers for maintaining poultry farms.

Scheme No. I—*Improvement of Poultry in villages.*—This scheme aims at improving the laying capacity, the size, the colour and the general performance of the country flock by introducing pure blood. The cockerels (ready for use) of improved pure breeds of fowl, acclimatized in India and noted for their egg laying capacity are selected to be distributed free among the villagers who keep country fowls and are interested in poultry farming.

During the year under review 490 cockerels were put out in various Districts. Out of these, 288 are White Leghorns, 114 are Rhode Island Red, 59 are Black Minorcas, 14 are White Wyandottes, 6 are Light Sussex, 5 Well-Summer and 4 are Australorps.

In most parts of the Bombay Province, the hatching season commences from October and ends by March every year. The pure bred cocks are put out before or during the hatching season. The grades have taken up the characteristics of the sire and are found doing extremely well. In most villages, the pullets are laying and laying a larger egg than their dams. The number of eggs laid by the graded pullets has increased by about 40 per cent. Some females of the F-4 generation are laying eggs. each weighing 2·0 ozs. i.e., equal to the size of an egg laid by pure bred hens. This, however, requires selective breeding to keep it up in future generations.

Diseases of poultry are numerous and alarming to poultry farmers at odd times of the year. Disease is found to be the greatest *obstacle* in the development of Poultry industry. Ranikhet, Roup, Chicken pox Tick fever and diarrhœa are the common diseases found in village poultry. The only remedy to overcome these diseases is to practice preventive measures against various diseases. This requires constant training and propaganda.

Marketing of better quality eggs at better prices is another question that requires immediate attention. At the present moment, the farmer has only one outlet for his eggs and that is the village egg collector or Dalal, who pays no extra money for large fresh eggs. It is, therefore, very essential to have one central organisation which shall secure a fair price for the better quality egg that we are now producing in our villages.

SCHEME, NO. II—*Scheme for the encouragement of pedigree Poultry Keeping in villages by grant of premia to poultry farmers for maintaining poultry farms.*—The idea underlying this scheme is to popularise poultry keeping on upto date lines among intelligent poultry farmers. Two types of cash Premia are given one for housing of Rs. 100 each and the other egg and fowl premium of Rs. 75 each. Six such housing Premia and eight egg and fowl premia are awarded during the year under report to 14 poultry farmers.

District Poultry Centres.—This scheme aims at improving the village poultry of the District by running a small poultry farm and distributing pure bred stock to the farmers round the centre. This is financed from the Village Improvement Funds placed at the disposal of various Collectors.

The District Poultry Centre in East Khandesh is run under the direct supervision and control of this section. During the year under report, we have distributed the following stock in Bhusawal, Rawer and Yawal talukas of East Khandesh district.

White Leghorn cocks	54
White Leghorn hens	10
White Leghorn setting eggs	1,800
Portable Poultry houses	7

This stock is frequently inspected by the local Poultry Kamgar and the villagers are advised in their proper management.

The District Poultry Centres in Kaira and Sholapur districts are independently run by the respective District Committees. The activities of the District Poultry Centres in Kolaba and Thana were stopped in March 1940 for want of sufficient funds. A District Poultry Centre is being opened at Telgi in Bagewadi taluka of Bijpur District.

Egg Marketing Scheme, Belgaum.—This scheme is financed from the Sir Sassoon David Trust Fund. Rao Saheb V. V. Shirgaonkar, B.Ag., continued to supervise the working of the scheme. 81,690 eggs were handled during the year under report. These eggs were graded and then sold under "*Agmark.*" The percentage of various grades was as under :—

Class.	No. of eggs falling in the class.	Percentage of eggs in total collection.	Selling price at Belgaum.
			Rs. a. p.
Special	129	0·16	0 9 0 per doz.
A	352	0·43	0 9 0 ,,
B	4,383	5·37	0 7 0 ,,
C	69,495	85·03	0 5 0 ,,
D	7,361	9·01	0 4 0 ,,

The percentage of bad eggs to good eggs was very low i.e., 2·0 per cent. only. Efforts are being made to secure better prices for better quality eggs.

We had to face some difficulties even in selling graded eggs at Belgaum during the past year and recommendations were made that Government and other institutions such as Hospitals and Schools should be made to purchase such graded eggs.

The Infants and Public Milk-Supply Company, Ltd., Palghar.

The Company is carrying on various improvements suggested to them. The milch stock at the beginning of the year was 33 cows and 186 buffaloes, while at the end of the year it was 24 cows and 290 buffaloes. The Company purchased 136 buffaloes during the year. The total quantity of milk produced during the year under report was 6,33,999 lbs. as against 4,45,749 lbs. for the previous year. Milk supplied to the City of Bombay during the year was 6,22,076 lbs. The area of 350 acres for hay making produced 12,29,250 lbs. of hay as against 11,19,250 lbs. for the last year. Fodder crops were grown on an area of 43 acres of land which yielded 4,52,348 lbs. of green fodder. 1,60,000 lbs. of green grass was ensilaged during the year under report.

The Bombay Gowrakshak Mandali.

Since 1924-25 the Bombay Gowrakshak Mandali is co-operating with the Livestock Section in the improvement of the Gir cattle at their two farms at Kandivali and Betegaon. The milking stock is kept at Kandivali while the growing and the dry stock are kept at Betegaon.

Personnel.—Mr. K. K. Shukla, B.Ag., held charge as Manager at Kandivali while Mr. D. M. Bhave was in charge of the Betegaon Farm.

Livestock.—The year began with 313 heads of pure bred Gir cattle and ended with 294 as against 298 and 273 respectively for the last year. During the year under report 22 heifers came into milk as against 19 in the previous year. The average age at first calving of the heifers works out as 4 Years and 11 days as against 4 years 1 month for the previous year's batch.

Milk Production.—Out of the 68 cows that completed their lactation during the year were 17 cows which yielded more than 4,000 lbs. of milk. One cow Hemavati yielded 10,411 lbs. of milk in 575 days. The following table compares the milk yield of the Gir Cows with that of the previous year :—

Year.	Cows.		Total Cows.	Total milk yield in lbs.	Annual average milk yield per cow (including dry cows) in.
	In milk.	Dry.			lbs.
1938-39	46	33	79	** 1,79,983	** 2,276
1939-40	48	32	80	** 2,00,587	** 2,506

** Exclusive of milk suckled by calves.

The milk is supplied to different Hospitals, Welfare centres and schools at Bombay and to the Government Physical Training Institute at Kandivali at concession rates. The Manager supplied the lactation records of the Gir Cows for publication to the Imperial Council of Agricultural Research Institute, New Delhi.

Supply of Breeding Bulls and Cows.—During the year 17 breeding bulls were placed out for cattle improvement in the districts as against 11 in the previous year. Eight Gir cows were supplied free to the Motichand Gowtamchand Agricultural School at Puntamba in Ahmednagar District. The Mandali also supplied 14 Gir bullocks to various institutes.

Fodder Production and Hay making.—The area under fodder crops was 31 acres and 14 gunthas under irrigation—24 acres and 14 gunthas at Betegaon and 7 acres at Kandivali. Besides there was an area of 34 acres under Rabi jowar fodder—21 acres at Betegaon and 13 acres at Kandivali. The total production of fodder was 10 lac lbs. of green fodder, which works out 15,000 lbs. of green per acre.

About 17¾ lac lbs. of hay was made on both the farms as against 20 lacs of lbs. during the previous year. The reason for less manufacture of hay was due to less rainfall and feeding of the green grass during the scarcity period of rain.

Services rendered to the Public.—The Mandali is rendering free veterinary help in treating the farmer's cattle round about. During the year 3928 cases were treated and 4,482 cattle were treated for ticks in the cattle dips maintained at both the farms. The Mandali is maintaining 3 Premium Bulls for giving free services to cattle round about. The Mandali donated a sum of Rs. 821 for the protection of cattle in Gujerat during the scarcity period of the year.

Training in Animal Husbandry and Dairying.—The Mandali very kindly afforded facilities in training of students in Animal Husbandry and Dairying. Nine students were trained by the Manager during the year.

General.—The Mandali co-operated in sending their best Gir cattle to the Third All India Cattle Show held at New Delhi in February 1940.

The Honorary Secretaries and the office Manager of the Mandali spared no pains to maintain the efficiency of the cattle breeding farms.

The Nathu Lalji Charity Trust Fund, Gowshala, Mulund.—The Board of Trustees of the Nathu Laljee Charity Trust Fund, Gowshala, Mulund, agreed to co-operate with Government in the improvement of Gir Cattle for a period of 5 years from 1st April 1939 on the grant of subsidy of Rs. 2,000 per annum on the following main conditions.

(1) The Gowshala should set aside a sufficient number of Gir cows headed by bulls selected by the Agricultural Department to produce at least 20 bulls each year.

(2) The Gowshala shall retain such bulls as are required by the Trustees for the farm and Government retains the right to purchase the remaining bulls as and when required at a fixed price of Rs. 200 each for a bull 3½ years and over in age.

(3) The Trustees will appoint a Manager approved by the Livestock Expert to Government and to maintain all suitable Cattle Breeding Records.

Personnel.—Mr. K. G. Saraiya, B.Sc., (Agri) held charge of the Gowshala since September 1939.

Strength of cattle.—The Gowshala had 248 heads of cattle at the end of the year consisting of 79 cows ; 79 heifers, 77 bull calves and 4 breeding bulls. The herd consists of pure bred Gir and Gir graded cattle. During the year 17 heifers came into milk. Their average age at 1st calving works out 4 years, 2 months and 9 days.

Milk Production.—During the year 1,28,418 lbs. of milk was produced. The average number of milch cattle was 33 and the average per head per day of the milking stock works out 10·6 lbs. The farm had 11 Gir cows yielding over 4,000 lbs. of milk in a lactation. The cost of milk production is Rs. 7 per maund and the delivery charges work out Rs. 1-14-0 per maund.

Supply of Breeding Bulls and Cattle.—10 breeding bulls are ready at the Gowshala for putting out in the districts. The Gowshala supplied 6 cows and 4 young calves during the year.

Cultivation.—The Gowshala has 79 acres of land. The area under well irrigation was 2 acres and 1 acre under Shalu-jowar and one acre under Guinea grass, and Elephanta grass. The out-turn of Shalu was 4,000 lbs. Out of the above area, 40 acres are given for rice cultivation and 34 acres of land is hilly and is used for the exercise of cattle. 4½ lakhs of lbs. of grass were purchased from outside.

General.—The Gowshala sent 8 of their best Gir cattle for the Third All India Cattle Show held at New Delhi in February 1940.

Taluka Development Agricultural Association, Cattle Breeding Farms.

There are two Nimar Cattle Breeding Farms in East Khandesh conducted by the Taluka Development Agricultural Associations, Jalgaon and Jamner at Pimple and Gangapuri respectively. These Cattle Breeding Farms are at present being subsidized by Government as per G. R., R. D., No. 377/33 of 24th March 1936 up to the extent of Rs. 1,000 per year. With a view to achieve economy and efficiency the Expert Cattle Committee had recommended in paragraph 41 of their report that :—

> " the management of the Gilligan (Pimple) Cattle Farm, Jalgaon, " and the Gangapuri Cattle Farm (Jamner) should be requested to " amalgamate the two Farms into one farm i.e. East Khandesh Cattle " Breeding Farm, dealing with the Nimar breed, the existing Pimple " Farm being utilised as a Dairy Farm solely and the Gangapuri Farm " for the rearing and maintenance of young and dry stock ".

If the proposal of amalgamation were to be accepted Government were asked to provide the combined farm, a qualified Manager, for a period of 5 years and to take 20 approved bulls annually at Rs. 250 each to replace the subsidy indicated above. Attempts were made to explain the position fully and how it was in their own interests to amalgamate

both the farms for obtaining increased economy and efficiency, but the farm authorities do not favour the proposal. The progress made by these farms during the year is described below :—

(1) *The Pimple Cattle Breeding Farm.*—There were 139 heads of Nimar cattle on the farm at the end of the year consisting of 39 cows ; 33 heifers, 35 bull calves and 30 young stock and two breeding bulls. There were 16 male and 23 female calves born during the year. The farm supplied 10 Premium Bulls, 15 cows and 5 heifers on Cow Premium System for improvement of cattle in the district during the year under report.

32 cows were milked, producing 18,937 ½ lbs. of milk. This quantity of milk was obtained by milking two teats from each cow and leaving remaining two teats for the suckling of the calves. Good cows have produced up to 1,500 lbs. of milk in a lactation from two teats.

The milk was supplied to Jalgaon town at the rate of 10 lbs. per rupee fetching Rs. 1,485. The Farm has leased 80 acres of land at Rs. 300 per year for cultivation. About ⅔rd of the area was under fodder crops and ⅓rd under ground-nut and cotton. Besides the farm has been given by Government an area of 403 acres of good grass lands on lease at Re. 1 per acre. About ⅓rd of the area is used for grazing and the remaining ⅔rd is reserved for hay and silage. The production of hay from 300 acres was 1,00,125 lbs. Three silo pits were filled with 2,90,000 lbs. of green fodders consisting of 83,000 lbs. maize ; 1,78,000 Nilva and 29,000 lbs. of grass.

The farm is also maintaining a poultry farm and had 174 birds at the end of the year. The farms supplied 59 improved cocks, 49 improved hens for village improvement. 4,840 hatching eggs were supplied to 200 farmers in 130 villages. In addition 6,121 table eggs were sold. The Association has also maintained a small unit of the poultry farm at Jalgaon proper in its office premises on a piece of land of 145′ × 50′ for the purpose of visual demonstration to village people who come on bazaar days. The farm sent one breeding bull, 2 young bulls, 5 cows, and ons heifer to the Third All India Cattle Show, New Delhi and won the Holkar Government Challenge Cup in addition to Rs. 150 in cash.

During the year the farm received Rs. 1,500 for construction of two pucca silo pits and Rs. 1,000 for extension of water piping for growing of fodders from the East Khandesh Rural Development Board. The silo pits have been completed.

The management of the Taluka Development Association, Jalgaon, especially their President, Secretaries, and the Overseer Mr. Salunke deserve high praise for their untiring efforts to advance the interests of the farm.

(2) *The Gangapuri Cattle Breeding Farm, Jamner.*—The Farm had 71 heads of Nimar cattle consisting of 22 cows ; 21 heifers, 18 young bulls

and 8 young stock and one breeding bull at the end of the year. There were eight male and four female calves born during the year. The farm will be in a position to supply about 6 bulls during the coming year. 10 cows were milked during the year producing 3,590 lbs. of milk from two teats. The milk is sold to Jamner town at the rate of 10 lbs. and fetched Rs. 155. The area under fodder crops was 59 acres consisting of 40 acres under pulses such as kulthi, Math and Tur ; 17 acres under jowar and 2 acres under lucerne. The farm has been allotted 150 acres of grazing land on lease for 4 years since the last year for rotational grazing and silage making. The farm cut 58,275 lbs. of hay and about 32,000 lbs. of green grass for silage making during the year. The Mamlatdar of Jamner is to be thanked for taking a keen interest in the management of the farm.

Poultry Research Scheme financed by the Imperial Council of Agricultural Research, New Delhi.

To make the Poultry industry still more useful in India as a home or cottage industry, the following essential investigations were proposed to be carried out in a Five Year—Poultry Research Scheme started in October 1936 :—

(1) Study of a few of the European and American breeds, particularly Mediterranean breed that have proved themselves more or less suitable;

(2) A study and purifying of a few of the better known Indian breeds or breeds that have been known to exist in India for many years, such as—

(*a*) White Chittagong or Bramhaputra,

(*b*) Karaknath breed,

(*c*) Firangi or the Naked Neck,

(3) The combination of useful characters of foreign and Indian, breeds by crossing ;

(4) Investigation into the different types of Poultry Farming—intensive, semi-intensive types for would be pedigree breeders and the free range system for purely egg farmers ;

(5) Investigating modern hygienic methods of housing, which is to include cheap types of houses, runs and appliances to suit the poorer class of people ;

(6) Investigation into incubation-artificial and natural, testing eggs, storing eggs for hatching and marketing eggs-packing and transport ;

(7) Investigation in Nutrition including feeding with cheap foods available in villages ;

(8) Investigation into the best methods of introducing better poultry keeping in villages, co-operative marketing, etc. ;

(9) Method of passing on knowledge obtained into villages.

This scheme was sanctioned for a period of 5 years and will terminate in October 1941. The above programme of work is being carried out at the following three centres from the commencement of the scheme—

(*i*) Government Central Poultry Farm, Kirkee.

(*ii*) American Marathi Mission Vocational School, Vadala, District Ahmednagar.

(*iii*) Vocational Training School, Ankleswar, Broach district. The detailed report of the investigations carried out at the three different centres during the year 1939-40 is being submitted separately to the Imperial Council of Agricultural Research.

The following is the brief summary of work done during the year under report.

Strength of the flock on 30th June 1940 was as under.—

Kirkee Centre—589 fowls and 46 ducks.

Ankleswar Centre—119 fowls.

Vadala Centre—108 fowls.

Incubation.

Kirkee Centre.—Artificial incubation was conducted for nine months during the year under report. 471 chickens and 64 ducklings were hatched during the year under review. The hatching percentage of this year was 65·7 per cent. as against 69·72 per cent. in the previous year.

Ankleshwar Centre.—The comparative result of Monsoon and Winter hatching is shown below :—

Season.	No. of eggs.	Infertile eggs.	Germ or chick died in shell.	No. of chicks hatched.	Percentage.
Monsoon	271	100	63	108	63·1
Winter	278	139	81	58	41·7

Vadala Centre.—239 eggs were set for hatching out of which 79 were infertile, 13 dead germs, 37 dead in shells and 110 chickens were hatched. The percentage of hatching on the fertile eggs was 74·8 per cent.

The salient features of the Experiments carried out during this year are as under :—

KIRKEE CENTRE.

I. *Laying trials.*—Flock average and size of eggs of different breed of poultry :—

Serial No.	Breed.	Flock average.	Size of eggs in ozs.
1	Light Sussex	167·8	1·95
2	White Leghorn	230·66	1·96
3	Rhode Island Red	184·48	1·90
4	White Leghorn × Rhode Island Red ..	192·62	1·80
5	Chittagong × Rhode Island Red ..	111·6	1·44
6	Naked Neck × White Leghorn ..	202·0	1·55

II. *White Leghorn* × *Rhode Island Red Cross.*—White Leghorn hens were crossed with a Rhode Island Red cock with a view to combine the egg laying quality of the White Leghorns with the table quality and the resistant nature of the Rhode Island Red in one breed of fowls, the results were very interesting. The offsprings appeared plump and robust from the beginning indicating the table quality and hardiness. They were found to be very heardy and quick growers.

The flock average record of the grown up pullets was maintained and it was found to be 192·62 eggs per bird per year with an average egg size of 1·8 ozs.

From our experience and the records kept, we can definitely recommend to farmers who breed for table eggs and table poultry the cross bred White Leghorn × Rhode Island Red. This has proved to be an excellent cross, laying a large number of good sized eggs, which seldom goes broody and has no signs of drooping or getting ill.

III.—*Feeding Experiments.*—

(*a*) *Feeding of Wheat Bran mash* vs. *Lucerne Hay Powder Mash.*—

Results.—This experiment proved that Wheat Bran Mash is a little better than Lucern hay powder mash.

(*b*) *Feeding of Wheat Bran mash* vs. *Ashi* (*finer rice*) *bran mash.*—

Results.—Wheat Bran mash helps greater production of eggs while the ashi bran helps in putting on more flesh.

(*c*) *Nagli grain feeding* vs. *Bajri grain feeding.*—

Results.—Bajri grain feeding is better than Nagli.

Ankleswar Centre.

Testing the laying capacity of different breeds of poultry—Results obtained :—

Breed.	Average No. of eggs per hen per month.	Average weight of an egg.
Rhode Island Red	10	1·9
White Leghorn	9	2·0
Country selection	5½	1·1

II. *Incubation trials at different seasons.—*

Results.—The hatches taken during Monsoon were in general successful, the hatching percentage was 63 per cent. in Monsoon while it was 41 per cent. in Winter.

Vadala Centre.

I. The flock average has been improved to 144 eggs per bird per year as against :—

138·8 eggs per bird per year in 1938–39.

129·7 eggs per bird per year in 1937–38.

127·6 eggs per bird per year in 1936–37.

II. *Feeding Experiments.*—Feeding of grain and mash ration VS. all grain ration.

Results.—Grain and Mash ration gave nearly double the yield of eggs and it was cheaper to the producer than the all grain rations.

III. *Cross Breeding.*—Chitagong hens were crossed with a Light Sussex Cock. The F-1 generation was found to be quite healthy and with very low mortality. Egg laying trials are in progress.

Scheme for breeding of Kamori Milch goats attached to the Poultry Research Scheme, Kirkee Centre, Poona.

This scheme was a new item of work undertaken during the year. Numerous enquiries regarding the use of goats as milk producers from different parts of the Province are being received and in view of the importance of the goat as a milk producer, especially among the poorer classes of the community in various rural areas, a scheme was prepared and submitted to Government to start a small experiment on goat breeding at the Poultry Research Station, Kirkee.

The Kamori breed of goat is found in Sindh and is reported to be a good milker yielding 6 to 8 lbs. of milk per day. During the year under report sanction was accorded to purchase 5 female goats (Does) and one male goat (Buck) at Rs. 55 each landed at Poona. Accordingly on 28th November 1939 five Kamori milking does with 5 kids at foot and one breeding buck were purchased from Mr. J. R. Patel of Karachi. The condition and health of the goats at the time of their arrival was good. The does had kidded about 3 weeks prior to their arrival at Poona.

Description of the Kamori goats.—These goats are fawn and deep chocolate in colour with lighter almost white spots. They are tall measuring 30" to 32" in the females and 34" to 36" in the male. The ears are pendant and measures 12" to 14" in length and 6" to 7" in breadth capacious. The weight of the female goats at the time of the arrival was 94 to 112 lbs. while the weight of the buck was 102 lbs. The weight of the kids was from 15 to 24 lbs.

Housing.—One galvanised corrugated shed measuring 32' × 12' was constructed at a cost of Rs. 200 against the side wall of the store room at the Poultry Farm.

Feeding and Care.—One goat herd at Rs. 15 per month was employed to groom, feed, graze and milk the goats. The goats were daily groomed and taken out for grazing. The goats were found to like Babul pods, Ber leaves, Banyan and Audhambar leaves. The grazing was supplemented with Shevri and shalu-jowar, occasionally carrots were fed when available. As regards the concentrates fed, the goats seemed to prefer gram, wheat bran, maize, oats, barley and safflower seeds. They did not relish oil cakes.

The expenditure on fodders and concentrates purchased during the period under report for 7 months was Rs. 99-11-0, of which Rs. 76-11-0 was for concentrates, Rs. 23 on fodders. The average cost of purchased feeds, thus works out Rs. 1-6-0 per goat per month.

Milk-Yielding capacity.—An attempt was made to hand-feed the kids after the milking in order to ascertain the exact quantity of milk yielded by the does, but it was not successful. The kids were, therefore, allowed to suckle a few minutes before and after milking both times. The does were milked between 5 to 6 in the morning and 4 to 5 in the evening. The highest quantity of milk yield per doe did not exceed 4 lbs. per day. During the period of observation the 5 does yielded 323, 204, 227, 224 and 353 lbs. respectively during the lactation period of about 4 months on the Farm. If to this is added the estimated milk yield of the does prior to their arrival at Poona, the highest quantity per lactation of about 5 months would be 449 lbs. (vide appendix—VII—attached).

As regards the fat percentage of milk of the goats, recent tests have shown them to be 4·1 per cent. and 2·6 per cent. from the milk of two does. The lower fat test was of the milk from a doe which had kidded 15 days prior to the test.

Health and Service Record.—All the does came into heat after about 3 months after arrival. These does were served in the last week of January 1940 and two in the first week of February 1940. All the goats were in good condition and health for about 2½ months after their service when one doe "Lucy" aborted after a gestation period of 78 days. She has now recovered and is in good health.

Two more does "Barbara" and "Well Done" aborted after 111 and 119 days of pregnancy and both of these later on succumbed to "Pneumonia". One doe "Darling" gave birth to still born kid after 137 days of gestation. Only one doe "Mary" kidded normally giving one kid. Her gestation period was 155 days. There was no other casualty in the herd except one kid which died of "Pneumonia".

The strength of the goats at the end of the year was 3 Does, 1 Buck and 4 Kids.

Production and sale of milk.—The total production of milk was 1371 lbs. and 14 ozs. of which 1259 lbs. and 15 ozs. were sold realising Rs. 141-1-0. There was a brisk demand for the goats milk and many customers had to be refused.

Expenditure and Receipts.—The total expenditure on running this small unit of the goat farm was Rs. 798 while the receipts were Rs. 138.

General.—The farm was managed by Mr. V. C. Charanti in addition to his own duties as Manager of the Poultry Farm.

It is very doubtful if this breed of goat is going to be of much value in the Deccan. However the experiment may be continued until we can ascertain what the progeny born and reared in Poona will do in the way of milk and standing the climate.

Formation of Milk Recording Societies as an aid to developing high milk yielding strains of the more Important Indian breeds of cattle.

The object of the scheme is to start village milk recording in respect of those breeds of Indian cattle in regard to which action has already been initiated by the Imperial Council of Agricultural Research for the establishment of Herd Books.

The Government of Bombay has accepted the offer of the Imperial Council of Agricultural Research to finance half the cost (i.e. Rs. 960 of the village milk recording work in the Kankrej tract of the Province for a period of two years.

A milk recorder was appointed on 17th May 1939 and was given a practical training at the Chharodi Cattle Breeding Farm for a period of fortnight in milk recording, testing etc. After this period, his headquarters were located at Sanand in Ahmedabad District. For the purpose of milk recording 9 villages in Sanand taluka where Premium Bull work has been in progress for the last 15 years were surveyed and cows earmarked for the purpose, with the co-operation of the Kankrej cattle breeders in these villages. The names of the villages selected are :—

(1) Sanand.
(2) Vasodra.
(3) Rupvati.
(4) Lekhamba.
(5) Goraj.
(6) Phangadi.
(7) Kodalia.
(8) Nethrad and
(9) Godhavi.

The actual work of milk recording commenced in September 1939 with 99 cows for milk recording. From September 1939 to March 1940 the milk record of 157 cows was tested fort-nightly both for quantity and quality of milk. Out of these cows 112 cows were the progeny of the Premium Bulls. During this period 78 cows went dry and 28 cows were discontinued either due to selling or being required to be sent out for grazing, thus leaving 59 cows on 1st April. Full report of the scheme is being submitted to the Imperial Council of Agricultural Research.

Formation of Kankrej Breeding Society.—Efforts were made to form a "Kankrej Breeders' Association". A meeting of 169 cattle breeders of 24 villages of Sanand and Viramgaum talukas was held in October 1939 for the purpose of explaining the objects of the proposed Society or Association. There was a satisfactory response. But unfortunately famine conditions prevailed in the breeding area and the formation of the Society had to be postponed. The matter would be pursued during the current year.

Sheep Breeding Farm, Poona.

Personnel.—Mr. S. S. Khot, B.Ag., held charge of the Farm as the Manager during the year under report.

Mr. A. K. Deshpande, B.Sc., joined the farm voluntarily to study the problem of wool quality.

The work carried out is dealt with in the same sequence as in the previous year.

Selection of Deccan Sheep.—To the problem of selection for uniformity in wool bearing character, the factor of stamina has to be added. The stamina in sheep is its staying power to yield to human endeavour. How long does the Deccan Sheep "stay" to yield in this tract? Due to haphazard and purposeless inbreeding, there is very little stamina in these animals. The shepherd's flocks in Deccan very seldom increase. The births just balance the figure of deaths. A ewe lambs for the first time at the age of a year and a half and a second by the time it attains its full mouth. With the third lamb its wool bearing character is negligible. A nursing ewe at this stage does not yield more than 4 ozs. of wool and the livability of lambs from such ewes is very low. This farm has a small unit and it is hoped that if the proposed sub-stations are sanctioned it will be easier to deal with the problem of stamina, where the test of stamina could be guaged and with the larger number of sheep to study there will be a greater opportunity to select sheep with sustaining power to yield better wool.

The object of selection of the Deccan Sheep is to improve the wool bearing quality of this breed. The wool quality can only be improved by studying the fleeces of individual sheep. After a preliminary study of the types of fibres in the previous year the existing farm flock is classed into—

(1) Grade "A".—Sheep carrying fleeces containing no hair.

(2) Grade "B".—Sheep carrying fleeces containing long hairy fibres which have the characteristic of growing without the usual seasonal break.

(3) Grade "C".—Sheep carrying fleeces containing short, hairy fibres, which are seasonally shed.

The spinning limit of the average Deccan wool is from 2 to 5 counts (woollen). Exceptional fine blankets are prepared from yarn of 10 counts. The "A" Grade mentioned above can easily be spun up to 30 counts and the "B-Grade" to 15 counts. The "A Grade" will take a dye while "B and C" grades absorb dyes in an uneven manner. Obviously, the work of selection is to be directed in breeding from and improving upon this superior sheep of the "A-Grade" type. This requires a system of recording the quality of fleece of individual sheep so that one would not only know the trend of improvement but would be able to select sheep which are to head stud flocks. This year the fleeces of "A-Grade" Deccan Sheep have been completely studied and the work is classified as under:—

(1) Study of the coat of the "A-Grade" Deccan Sheep and demarking of zones which stand out by themselves from the point of wool quality.

(2) Study of Types of fibres.

(3) The proportions of fibres on an individual sheep and as distributed on different zones.

(4) The problem of the minimum number of tests required to obtain a reliable mean in calculating the measurable attributes of fibres.

(5) The quality of wool on each zone with its bearing on selection and wool classing.

(6) The method of selecting the best sheep from the point of wool quality.

These points have been worked out in detail and a method of recording the performance of an individual sheep and its progeny has been tabulated after the manner of the card index advocated by Dr. Waters of Massy Agricultural College of New Zealand. A simpler method of recording has been worked out to suit the problems of this farm. But the greatest drawback in making headway with the results obtained, lies in the lack of numbers of sheep at the farm for improvement of the breed. However, it is hoped that this difficulty will be got over when the proposed sub-stations are sanctioned.

Adaptability of the Merino to the Deccan environment.—The adaptability in sheep is its inherent and the acquired ability to live to procreate and to yield to human endeavour in a given environment. The Merino sheep on the farm have to go through the following tests—

to acquire the constitution to live;

to procreate meaning services from rams and lambs from ewes;

to yield wool.

The important ewes have either adapted themselves to live or the detailed schedule of management worked out last year fits the bill and it is hoped that the problem of lambing which has been the stumbling block this year is also solved. From the experience gained to-date, it is hoped that there will be little trouble in getting the best out of the Merino rams on this Farm. One purebred Merino ram born on the Farm has been located in a shepherds flock in Sholapur District. The report of his working is highly satisfactory.

Crossing of Deccan Sheep by the Merino.—The services from the Merino rams have been satisfactory but due to the very small number of Deccan Sheep on the farm, only 20 ewes were shown to the Merino ram. Out of these, 17 ewes yielded lambs. With such a small lot, it is not possible to arrive at any proportions on colour and quality characters. However, with this and the batch of the previous year, it can be laid down that four types of lambs are born as differentiated by the colour of the fleece—

1. All black.
2. Spotted.
3. White with black face.
4. All white.

The average weight of the fleece in two shearings of the first year has been 4 lbs. for a ram and 3 lbs. 12 ozs. for a ewe (please note that the averages are from a small number of cross breads of the previous year). The quality is decidedly superior to Deccan and commercially approaches very near to Merino. The real difficulty in the progress of this work on the farm lies in not having sufficient sheep for trials and secondly in the want of a small wool testing branch to give ready help in matters of selection of breeding stock on the bases of quality. In lieu of this proposed development of research the farm will simply remain in the stage of recording observations only.

Miscellaneous Problems.

1. *Time of lambing.*—This problem has been solved in the previous year. The results of this year corroborate the experience detailed in the report for 1938–39. It is now a definite policy not to breed ewes later than July.

2. *Dipping.*—The Deccan Sheep must be washed prior to dipping. Hard water should not be used for preparing the dip.

3. *Shearing.*—The Deccan Sheep are shorn once at the end of August and secondly in the first fortnight in January. With the experience of the last two years, it is decided to delay the winter shearing till the middle of February. A strange phenomenon in loss of weight after shearing was observed in case of Merino. Details will be worked out in the coming year.

4. *Docking.*—The wound necessarily arising from docking heals very quickly if the operation is carried out at the end of a week after birth.

5. *Worms.*—This year there was little trouble of worms for the major portion of the year.

Prbblem of grazing.—The problem of grazing in sheep improvement is of as great an importance as that of breeding. Unless optimum conditions of feeding are given to sheep there is no possibility of a flock showing its full capability and thus the selection for high yielders can only be made from those animals which respond to such treatment. The optimum conditions for grazing of sheep can be enumerated as follows :—

(1) The grazing lands should carry short grass in a green state throughout the year.

(2) There should be facility to give the flocks a change of pasture.

(3) There should be an active legume mixture.

(4) Availability of weeds and bushes is also essential for maintaining health.

In the Deccan the shepherd gives his flock a chance of fulfilling these conditions by itinerating. But the farm flock must be stationary on an allotted area. In this area the life history of the pasture begins and ends with monsoon and this land can carry sheep till the end of December. It might be necessary to find a suitable area for summer grazing but for the present part of this difficulty is solved by storing young hay. A fortnightly analysis of the pasture was undertaken and it was found that the best time to cut hay was the middle of July, when the grass has taken a six week growth. It is most nutritious at this stage.

On the Farm area the dominant grass land legumes are Phseolus-trilobus and Indigofera-cordifolia on the higher soils and Heylandia-latabrosa on the lower lands of the better soils. The nutritional values of these on dry bases are higher than lucerne. A list of useful bushes was prepared and their leaves analysed for their nutritional values. It was found that although the sheep have no tendency to browse on these bushes with the same affinity as goats, these bushes are extremely useful in making up part of the mineral difficiency of the grasses. This farm is a small test unit and further development work on the problem of grazing in relation to sheep improvement can only be studied, when the sub-stations are sanctioned.

Tenguri Sheep.—This is a hairy breed of sheep found in southern part of Bombay Deccan. From the conformation of the majority of the Deccan sheep and the peculiar growth of wool on different regions, along with the colour pattern of the face, the Deccan Sheep is undoubtedly an outcome of a cross between the Tenguri and some wool bearing breed of this country. These sheep present an appearance of purity of type, which all important factor is absent in the average Deccan Sheep. A flock of twenty ewes and one ram was located on the farm for trials with an idea to study the possibility of developing this breed into a mutton type. It is a far better built animal than the Deccan sheep and as it is, these sheep fetch almost double the price in the market as compared to the average Deccan Sheep. Secondly this being a pure hairy animal it will help in the study of inheritance of fibre character when crossed with the Merino.

Wool Utilisation Section.—This has been an important addition to the activity of the farm. When the methods of sheep improvement are introduced in the villages, it will not be possible to raise sufficient quantities of improved wool in the beginning for a large scale industry. The object of this branch is to find out ways and means of utilising the small produce in villages so that the work of sheep improvement is not stranded at the outset. This branch is helping to a great extent with the study of wool quality. The work done on spinning trials can be briefly stated as follows :—

(1) A simple method of turning the single yarn into plies has been worked out on the foot-charkha.

(2) The following are the spinning tests of the different types of wools produced on this farm :

	Class of wool.	Count limits (Woollen).
1.	Deccan A grade	20 to 32
2.	Deccan B grade	8 to 12
3.	Deccan C grade	2 to 3
4.	Cross Bred	30 to 50
5.	Merino	30 to 75

(3) A variety of colours in browns, yellows, tans, khakis and grays dyes have been worked out from shrubs available on the farm area.

General.—I must thank Dr. Nazir Ahamad, Director of the Cotton Technological Laboratory, Matunga, Bombay, for his help in statistical part of wool fibre study.

Provincial Fodder and Grazing Committee.

Since its last meeting held on 22nd January 1939, the Provincial Fodder and Grazing Committee did not meet until the 6th June 1940, when almost all the Districts, with the exception of five Districts, had formed their District Fodder and Grazing Committees.

2. *Action taken on the proposals made in the previous meeting of the Provincial Fodder and Grazing Committee.*—As to the several proposals made by the Committee, the following schemes were submitted to Government, and the decision arrived at by Government is given below :—

(1) *Colonisation of Rabaris.*—A more comprehensive scheme was drawn up as desired by the Committee, and submitted to Government, but Government, after full consideration, decided that the scheme should be dropped.

(2) *Reclamation of Marl lands.*—Government approved of the conducting of this scheme in Sholapur District during the year 1941-42, under the supervision of the Chief Investigator, Dry Farming Research Scheme, Sholapur, subject to the approval of the Imperial Council of Agricultural Research.

(3) *Establishment of Central Research Station for improvement of grass and pasture legumes.*—The Economic Botanist to Government submitted a scheme through the Director of Agriculture to the Government of Bombay for forwarding it to the Imperial Council of Agricultural

Research for sanctioning the requested grant. This scheme was considered by the Central Fodder and Grazing Committee in their meeting held in June 1940, and this Committee decided that grass breeding work should not be carried out pending the appointment of a qualified Agrostologist.

(4) *Improvement of grasslands by means of small grassland experimental areas.*—Government accepted the Committee's proposals as recommended by the Director of Agriculture, to make experiments in selected villages by allotting kurans to villagers free of charge, and the Rural Development Department have been authorised to undertake the necessary propaganda work for the selection of the sites for demonstration.

3. Further progress made by the Committee was in the direction of suggesting a scheme for drying of green grass to the Imperial Council of Agricultural Research. The Central Fodder and Grazing Committee, in their meeting held in November 1939, approved of the idea underlying the scheme, and placed it with their recommendation with certain provisos before the Advisory Board. The recommendation of the Central Fodder and Grazing Committee was endorsed at the full meeting of the Advisory Board of the Imperial Council of Agricultural Research held in June 1940.

4. *General.*—About 918 copies of various proceedings of other Provincial Committees, important literatures received from the Imperial Council of Agricultural Research, and proceedings of various District Fodder and Grazing Committees—numbering about 51—were distributed to the Members of the Provincial Fodder and Grazing Committee; 209 copies of about 11 reports of the kind mentioned above were distributed to all the District Fodder and Grazing Committees in the Province; and 46 copies of each of the "Note on desirability and feasibility of storing grass for long periods against the years of bad rainfall", "Notes by the Professor of Agriculture on Storage of fodder", and the "Grass Drying Scheme" were sent to the Imperial Council of Agricultural Research. Thus the amount of work, considering the number of each report—which counted about 145—done on the Duplicator numbered about 7,000.

5. The meeting held on the 6th June 1940 had the following proposals for consideration, and the decision of the Committee on these proposals is summarised below:—

(1) *Survey of grasslands for increasing the production of fodder.*—The Committee appointed a Sub-Committee consisting of the Chief Conservator of Forests, the Director of Agriculture and the Honorary Secretary, to go into this question and to submit their proposals.

(2) *Reconsideration of the Forest Grazing Rules.*—The Chief Conservator of Forests was requested to move the District Forest Advisory Committees, by whom this question was being dealt with, to expedite their reports in the matter.

(3) *Improvement of drinking water facilities in forest grazing areas by means of wells and tanks, etc.*—The Forest Engineer submitted a detailed scheme for its introduction. The Committee, considering the scheme to be worth trying, recommended that the Chief Conservator of Forests should request the Government of Bombay to approve of few of the simpler projects being tried.

(4) *Note on Cattle Breeding in relation to grazing areas.*—The Honorary Secretary was asked to select a few typical areas wherein the present grass lands could be put to better use than as at present utilised by villagers.

(5) *Consideration of planting "Kiwane tree and Grand Star Grass".*—The Economic Botanist to Government is having trials with these plants, and the results of the experiment are being watched to see how these would suit Bombay Province conditions.

(6) *Imposing an enactment similar to the "Punjab Chos Act" for grass land improvement in the Bombay Province.*—The Committee was not in favour of having any such enactment, as the unanimous opinion of all was that it was neither desirable nor necessary to introduce such an Act into the Bombay Province.

(7) *Laying down some definite policy regarding financing the various activities of the District Fodder and Grazing Committees.*—The Committee resolved that no District Committee should undertake to do any grass land or fodder improvement without first obtaining the approval of the Director of Agriculture, and after his approval to any of their proposals that they should approach the District Rural Development Boards for any finance necessary.

6. *District Fodder and Grazing Committees.*—Out of 18 districts to have to form District Committees in the Bombay Province, the undermentioned 12 district formed Committees (the Broach and Panch Mahals having two separate committees), 2 (Kolaba and Nagar) have only elected their non-official members to work on the Committee, and 5 (Kanara, Nasik, Satara, Sholapur and Bombay Suburban) have yet to form their Committees.

7. The number of meetings held by the 12 districts which have formed full Committees were as follows:—

Ahmedabad, Kaira and Bijapur Districts—three meetings; Panch Mahals and Poona Districts—two meetings; and Broach, Surat, East and West Khandesh and Dharwar Districts, one meeting; no meetings were held by the Thana and Belgaum District Fodder and Grazing Committees.

8. The work done by the above mentioned first ten Committees is summarised below :—

(1) *Ahmedabad.*—This District Committee considered questions regarding growing of Anjan trees, encouraging silo pits, fencing and grazing lands by rotation, fixing the standard of grazing, improving the water facilities for grazing by sinking of wells, etc.

(2) *Kaira.*—The proposals made by this Committee were to have Government waste lands given to cultivators for fodder crops for one year on the condition that the person taking the land clears all scrub growth, etc., and thus improve the grazing areas by means of the income derived from the sale of trees and other produce growing therein. Cultivation on the Right Bank of the Mahi River is not to be permitted. They were suggested several names of fodder and fuel trees and grasses suitable for cultivation along the river bank. Plantation of Mysore Napier Grass, and road side trees having the best feeding value were some of their recommendations to improve the fodder resources and stop erosion of land.

(3) *Bijapur.*—The Committee considered the question of growing fodder trees and to carry out experiments on a small scale with the varieties of plants suitable for irrigated arid regions. They resolved that 3 acres per head of horned cattle and $\frac{3}{4}$ acre per head of sheep or goat should be considered a suitable standard for the whole District, and grant lands on temporary lease to private individuals or local bodies to grow fodder.

(4) *Panch Mahals.*—They have decided that Government be moved to limit the rates of sale of grass to Rs. 7 per 1,000 lbs. to extend the famine fodder storage scheme to Dohad and other villages, and purchase grass to be given on Tagavi, and some on cash payment.

(5) *Poona.*—Proposals to carry out propaganda work through the Rural Development Board for encouragement of bunding, improvement of grazing grounds, storage of fodder and elimination of non-essential cattle. Efforts are being made by the Rural Development Department and the Forest Department to persuade the villagers to conserve fodder by cutting grass from Kurans.

(6) *Broach.*—They proposed to construct silo and barns in suitable areas to supply silage and fodder to flood affected areas. This Committee, like the Panch Mahals, have also passed a resolution to fix the rate of fodder at Rs. 10 to 15 per 1,000 lbs.

(7) *Surat.*—This Committee has only decided to collect accurate data about the present areas under grass and fodder.

(8) *East Khandesh.*—The Committee passed a resolution to the effect that improvement and conservation of village grazing lands should be tackled by selecting villages where existing co-operative societies or panchayats can be placed in charge of the lands and asked to care for them. Encouragement of lucerne cultivation in the garden tracts, plantation of Anjan and Babul trees in suitable hilly lands near a village, starting of silos were some of the features considered by this Committee.

(9) *West Khandesh.*—In this District the Committee decided to request Government to form more grass kurans out of Reserve Forest area, and that growing of fodder crops in gurcharan land where the area is sufficient should be encouraged by giving concessions at half the rate of assessments, the money collected from this source of revenue will be spent on the improvement of grazing areas.

(10) *Dharwar.*—The Committee resolved to make a detailed survey of the areas which are affected, and to find out trees which are particularly suited for fodder in these areas, to arrange for growing grass on the banks of the Rivers, to adopt measures for the improvement of fodder by means of rotational grazing and contour bunding and to preserve Kadbi in good years of harvest and to undertake the planting of fodder trees for flooded areas in scarcity tracts.

Programme of Work under the Livestock Expert to Government, Bombay Province, Poona, for the year 1940-41.

I. *Cattle Breeding Farms.*—The policy of breeding reliable pure strains of cattle will continue (keeping in mind the production of a more economical animal which will mature early and calve more regularly) at the following cattle farms :—

(*i*) Government Cattle Farm at Bankapur in Dharwar District (Amrit Mahal breed).

(*ii*) Bombay Gowrakshak Mandali's Cattle Farm at Kandivali in Thana District (Gir breed).

(*iii*) Nathu Lalji Charity Trust Fund—Cattle Breeding Farm at Mulund near Thana (Gir breed).

(*iv*) Taluka Development Agricultural Association Farms in East Khandesh at Pimple and Gangapuri (Nimar breed).

(*v*) Government Cattle Farm at Tegur in Dharwar District (Dangi and Nimar breeds).

II. *Poultry Breeding Farms.*—Breeding of pedigree strains of improved breeds of poultry for supply in the districts at the following poultry farms :—

(*i*) Government Central Poultry Farm, Kirkee (Poona).

(*ii*) Government Poultry Farm, Dhulia.

(*iii*) Government Poultry Farm, Dharwar.

(*iv*) Poultry Research Scheme Farms financed by the Imperial Council of Agricultural Research at (*a*) Kirkee, (*b*) Ankleswar, and (*c*) Vadala centres.

III. *Sheep Breeding Farm.*—Sheep Breeding Farm, Poona, financed by the Imperial Council of Agricultural Research for—

(*a*) improvement of the Deccan sheep by selection;

(*b*) testing the adaptability of the Merino;

(*c*) crossing of Deccani sheep with the Merino;

(*d*) miscellaneous problems of sheep husbandry.

IV. *District Livestock Improvement Work and Propaganda.*—

(*i*) Working of the Premium Bull Scheme (Cow and Buffalo).

(*ii*) Working of the Premium Cow scheme.

(*iii*) Herd Registration of Purebred stock of cattle.

(*iv*) Working of the Livestock Improvement Act, 1933.

(*v*) Demonstrations of working of Cream Separator.

(*vi*) Working of the Milk Recording Scheme financed by the Imperial Council of Agricultural Research Poultry Research Scheme.

(*vii*) Village Improvement Schemes (*a*) Village Poultry Improvement on intensive scale (*b*) Poultry Station Schemes.

(*viii*) Fodder growing and silage making.

V. Rural Uplift Work.

VI. Palghar Dairy District Scheme.

VII. Provincial Fodder and Grazing Committee work.

VIII. *Advisory work*—

(*a*) General in respect of all items referred to above.

(*b*) Agricultural Institute, Anand.

IX. Research on "Kamori Goat Breeding Scheme" would be continued.

APPENDIX I.

Statement showing the prizes won at the Third All-India Cattle Show, New Delhi (Bombay Province).

Name of Institute.	Number of cattle sent.						Prizes won.
	Breed.	Cows.	Heifers.	Young Bulls.	Breeding Bulls.	Total.	
(1) Bombay Gowrakshak Mandali, Kandivali.	Gir ..	3	4	..	1	8	Heifer—II Prize—cash Rs. 50. Bull—IV Prize—cash Rs. 50.
(2) Nathu Lalji Charity Trust Fund, Mulund Gowshala, Mulund.	Gir ..	2	3	2	1	8	Cow—I—Cash Rs. 100 with Junagadhi Challenge Cup for the Best Gir Breed. Cash Rs. 50, Sayla Challenge for the Best Gir Cow in the Show. Cash Rs. 150 with Radha Mohan Memorial Cup for the best Milch type.
(3) Northcote Cattle Farm, Chharodi.	Kankrej	3	2	2	1	8	Bull—I with Hydrabad Challenge Cup for the Best Bull in the Show.
(4) Pandharpuri Khillar Breeders.	Khillar ..	1	2	2	2	7	Cow—II with Rs. 50 cash. Bull Calf—II with Rs. 50 cash. Heifer—II with Rs. 50 cash.
(5) Jalgaon Taluka Development Association Farm and Pimple Farm.	Nimar ..	5	1	2	1 and 2 bullocks.	11	Bull—I—Rs. 100 cash with the Holkar Government Challenge Cup. Bull—II—Rs. 50; Cow—I—Rs. 50 cash; and Rs. 100 for the Best Nimar Breed. Cow—II—Rs. 25 cash.
(6) Cattle Breeding Farm, Bankapur.	Hallikar	3	3	1	1	8	Cow—II. Heifers—I and II.

APPENDIX II.

Statement showing regularity in calving in Amrit Mahal Cows at the Cattle Breeding Farm, Bankapur, during the year 1939-40.

Serial No.	Brand No.	Name.	Date of last calving.	Date of present calving.	Interval between two calvings.	Remarks.
					Y. m. d.	
1	85	Gyara ..	3rd June 1938 ..	21st October 1939 ..	1 4 18	
2	95	Das ..	14th April 1938 ..	10th November 1939.	1 7 0	
3	167	Savantri ..	22nd January 1938..	2nd August 1939 ..	1 8 0	
4	186	Jangali ..	6th March 1939 ..	23rd June 1940 ..	1 3 0	
5	198	Jangali ..	17th December 1937.	12th August 1939 ..	1 8 0	
6	236	Gyara ..	29th January 1939 ..	18th January 1940 ..	0 10 20	
7	246	Laxmi ..	22nd March 1939 ..	14th March 1940 ..	0 11 23	
8	249	Jangali ..	9th February 1938 ..	15th August 1939 ..	1 6 6	
9	252	Jangali ..	12th February 1939.	21st January 1940 ..	0 11 9	
10	253	Gyara ..	5th February 1939 ..	15th February 1940..	1 0 10	
11	254	Handi ..	16th December 1937.	26th March 1940 ..	2 3 10	
12	258	Bokki ..	8th February 1939 ..	12th January 1940 ..	0 11 4	
13	262	Gyara ..	14th September 1938.	13th December 1939	1 3 0	
14	267	Das ..	1st May 1939 ..	29th May 1940 ..	1 0 28	
15	271	Mungari ..	13th June 1938 ..	12th March 1940 ..	1 9 0	
16	272	Chigari ..	9th September 1938.	11th September 1939.	1 0 2	
17	276	Dhagari ..	2nd October 1938 ..	2nd October 1939 ..	1 0 0	
18	277	Jangali ..	24th June 1938 ..	20th September 1939.	1 2 26	
19	283	Jangali ..	2nd September 1938.	10th October 1939 ..	1 0 1	
20	289	Jangali ..	19th May 1939 ..	26th April 1940 ..	0 11 7	
21	292	Jangali ..	18th August 1938 ..	30th October 1939 ..	1 2 12	
22	292	Savantri ..	21st December 1938.	12th December 1939.	0 11 22	
23	293	Kaweri ..	29th December 1938.	15th January 1940 ..	1 0 17	
24	297	Putali ..	10th October 1938 ..	21st January 1940 ..	1 3 11	
25	302	Gyara ..	29th November 1938.	24th March 1940 ..	1 3 26	

APPENDIX II—*contd.*

Serial No.	Brand No.	Name.	Date of last calving.	Date of present calving.	Interval between two calvings.	Remarks.
					Y. m. d.	
26	303	Jangali ..	5th January 1939 ..	24th January 1940 ..	1 0 19	
27	304	Badkati ..	20th August 1938 ..	28th November 1939	1 3 8	
28	305	Gyara ..	16th January 1939 ..	28th April 1939 ..	0 10 12	
29	306	Jangali ..	12th June 1938 ..	17th September 1939.	1 3 5	
30	311	Das ..	20th January 1939 ..	6th June 1940 ..	1 4 16	

APPENDIX III.

Statement showing acreage and yields of fodder crops together with the cost of production per acre at the Bankapur Cattle Breeding Farm for the year 1939-40.

Serial No.	Name of fodder crop.	Total area cropped.	Total yield of crops in pounds.			Average calculated yield of green fodder per acre.	Average cost of cultivation per acre.	Remarks.
			Green fodder.	Dry.	Seeds.			
		A. g.	Lbs.	Lbs.	Lbs.	Lbs.	Rs. a. p.	
1	Jowar-Chavli ..	8 0	90,624	44,500	2,800	24,900	48 0 0	Kharif crop.
2	Maize and Chavli	15 10	448,915	6,000	1,710	30,560	48 0 0	Kharif.
3	Maize ..	2 0	230,360	..	..	11,530	34 2 0	Rabi.
4	Ragi ..	3 10	47,539	..	..	14,628	32 4 0	Kharif.
5	Soyabeans ..	0 20	..	300	520	..	34 13 0	Do.
6	Chavli ..	2 0	23,320	..	..	11,660	35 3 0	Do.
7	Kulthi ..	8 30	12,150	15,700	3,600	6,545	23 12 0	Rabi.
8	Matki ..	5 0	13,800	..	..	2,760	23 10 0	Do.
9	Elephanta and Guinea Grass.	0 25	28,901	..	..	31,886	59 12 0	Irrigated.
10	Lucerne ..	0 5	3,782	..	..	30,256	265 15 0	Do.
11	Napier Grass ..	0 10	1,705	..	..	6,820	44 10 0	
	Total ..	45 30	693,796	66,500	8,630	1,71,545	650 1 0	

APPENDIX IV.

Statement showing single testing pen record of the Government Central Poultry Farm, Kirkee, for the year 1939–40.

Pen No.	Hen No.	Breed.	Number of eggs laid in 7½ months 16th November 1939 to 30th June 1940.	Total weight of eggs in ozs.	Average Number of eggs per year on the basis of 7½ months record.	Average weight of an egg in ozs.
1	1	*White Leghorn* ..	148	290⅜	236·80	1·96
2	3	Do. ..	125	237¼	200	1·9
3	5	Do. ..	150	301⅞	240	2·01
4	7	Do. ..	151	324 9/16	241·60	2·15
5	9	Do. ..	126	250 13/16	201·60	1·99
6	11	Do. ..	124	241 7/16	198·40	1·94
7	13	Do. ..	Died on 13th March 1940.			
8	15	Do. ..	89	180¼	142·40	2·02
9	17	Do. ..	108	232 13/16	172·80	2·15
10	19	Do. ..	130	252⅛	208	1·94
11	21	Do. ..	96	176 8/16	153·60	1·83
12	23	Do. ..	144	270⅝	230·40	1·87
13	25	Do. ..	Died on 16th April 1940.			
14	27	Do. ..	117	265 14/16	237·20	2·27
15	29	Do. ..	Died on 19th September 1940.			
16	31	Do. ..	150	310 11/16	240	2·07
17	33	Do. ..	60	110 10/16	96	1·84
18	35	Do. ..	153	302⅛	244·80	1·56
		Total of White Leghorn.	1,871	3,748	3,089·60	
			124·73	2	206	2

APPENDIX IV—*contd.*

Pen No.	Hen No.	Breed.	Number of eggs laid in 7½ months 16th November 1939 to 30th June 1940.	Total weight of eggs in ozs.	Average Number of eggs per year on the basis of 7½ months record.	Average weight of an egg in ozs.
1	2	*White Leghorn* ..	154	304$\frac{3}{16}$	246·40	1·97
4	8	Do. ..	145	309$\frac{5}{16}$	232	2·13
7	14	Do. ..	126	236$\frac{2}{16}$	201·60	1·87
10	20	Do. ..	121	255$\frac{1}{2}$	193·60	2·11
13	26	Do. ..	144	257$\frac{4}{8}$	230·40	1·78
16	32	Do. ..	152	261$\frac{7}{16}$	243·20	1·72
			842	1,625$\frac{1}{4}$	1,347·20	
			140·33	1·92	224·53	
2	4	Rhode Island Red ..	142	285$\frac{5}{8}$	227·20	2·01
5	10	Do. ..	143	281$\frac{8}{16}$	228·80	1·96
8	16	Do. ..	148	298$\frac{1}{16}$	236·80	2·01
11	22	Do. ..	151	294$\frac{7}{16}$	241·60	1·95
14	28	Do. ..	122	260$\frac{3}{16}$	195·20	2·13
17	34	Do. ..	184	311$\frac{1}{16}$	294·40	1·69
			890	1,729$\frac{1}{16}$	1,424·00	
			148·33	1·94	237·33	1·94
3	6	*Australorp* ..	151	306$\frac{1}{8}$	241·60	2·02
6	12	Do. ..	119	215$\frac{1}{4}$	190·40	1·81
9	18	Do. ..	118	216$\frac{1}{16}$	188·80	1·83
12	24	Do. ..	62	128$\frac{2}{4}$	99·20	1·08
15	30	Do. ..	66	127$\frac{3}{16}$	105·60	1·92
18	36	Do. ..	74	152$\frac{8}{16}$	118·40	2·06
			590	1,146$\frac{8}{16}$	944·00	
			98·33	1·94	157·33	1·94

APPENDIX

Statement showing the result of hatching per cent. of chicks breed by breed from 1st July 1939

Breed.	No. of eggs put in the incubator for hatching.	No. of eggs found infertile.	No. of eggs found broken yolk.	No. of eggs found addled.	Percentage of infertile eggs.	Percentage of broken yolk.	Percentage of addled eggs.	Total No. of eggs rejected.	Percentage of rejected eggs.
White Leghorn ..	1,004	233	75	19	23·20	7·47	1·89	327	32·56
White Wyandotte ..	527	197	39	13	37·38	7·40	2·46	249	47·24
Rhode Island Red ..	698	230	30	13	32·97	4·29	1·86	273	39·11
Australorp	497	216	47	5	43·46	9·45	1·06	268	53·92
Black Minorca ..	495	125	44	20	25·25	8·88	4·04	189	38·18
Well Summer ..	9	6	2	..	66·66	22·22	..	8	88·88
	3,230	1,007	237	70	31·14	7·33	2·16	1,314	40·68

V.

on the Government Central Poultry Farm, Kirkee, during the year 1939-40 *to* 30*th June* 1940.

Balance.	Half developed and dead in the shell.	Developed and dead in the shell.	Percentage of half developed and dead in the shell.	Percentage of developed and dead in the shell.	No. of chicks hatched.	Percentage of chicks hatched.	Chicks died or destroyed after hatching.	Percentage of chicks died or destroyed after hatching.	Healthy chicks taken into account.	Percentage of healthy chicks taken into account.
677	47	91	6·94	13·44	539	79·61	81	15·02	458	67·65
278	25	61	8·99	21·94	192	69·06	43	22·39	149	53·59
425	32	66	7·52	15·52	327	76·94	48	14·67	279	65·64
229	10	25	4·36	1·91	194	84·71	31	15·97	163	71·17
306	31	70	1·01	22·87	205	66·99	44	21·46	161	52·61
1	..	..	..	..	1	100 per cent.	1	100 per cent.	..	..
1,916	145	313	7·56	16·33	1,458	76·09	248	17·09	1,210	63·15

APPENDIX VI.

Statement showing the cost of hatching chicks on the Government Central Poultry Farm, Kirkee, during the year 1939-40 *from* 1*st July* 1939 *to* 30*th June* 1940.

No. of setting eggs issued for hatching.	Cost of setting eggs at Rs. 3-0-0 per dozen.	Quantity of Kerosene oil 150° water Lily Brand used for hatching.	Cost of kerosene oil used for incubator.	Number of chicks hatched.	Total cost of hatching chicks including the cost of setting eggs.	Average cost of chicks hatched including the cost of setting eggs.	Average quantity of kerosene oil used for hatching each chick.	Average cost of hatching each chick in an incubator.
No.	Rs. a. p.	Lbs. ozs.	Rs. a. p.	No.	Rs. a. p.	Rs. a. p.	Lbs. ozs.	Rs. a. p.
3,230	807 8 0	592 0	82 12 0	1,210	890 4 0	0 11 9·26	0 7·82	0 1 1·13

APPENDIX VII.

APPENDIX

Statement showing the milk yield of the Kamori Goats at

Name of the milking Doe.	Approximate date of calving.	Estimated milk yield in November 1939 prior to arrival in Poona.	Milk Yield in lbs. during (Produced					
			December.		January.		February.	
		lbs. ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
(1) Lucy	First week of November 1939.	90 0	92	4	98	2	86	6
(2) Mary	Do. ..	70 0	72	2	66	12	46	0
(3) Darling	Do. ..	90 0	90	8	89	5	47	0
(4) Barbara	Do. ..	70 0	75	0	80	15	52	4
(5) Well-done	Do. ..	90 0	98	2	103	6	80	14

VII.

the Poultry Research Station, Kirkee Centre, for the year 1939-40.

the months of on the Farm):					Total lactation yield after adding the estimated yield for November 1939.	Remarks.
March.	April.	May.	June.	Total production on the Farm.		
lbs. ozs.	lbs.			lbs. ozs.	lbs.	
46 15	Dry ..	..	..	329 9	419	Aborted on 18th April 1940.
19 8	Dry ..	..	..	204 1	274	Normally kidded on 2nd July 1940.
Dry ..	....	..	..	226 13	316	Aborted on 13th June 1940.
16 0	Dry ..	..	..	224 3	294	Aborted on 29th April 1940 and died on 2nd June 1940.
57 10	12 12	Dry	..	353 8	443	Aborted on 25th May 1940 and died on 15th June 1940.

APPENDIX D.

SUMMARY OF WORK DONE AT THE POONA COLLEGE OF AGRICULTURE, FOR THE YEAR 1939-40.

This is the 32nd year of the College.

Staff.

I was in charge of the College as Principal during the year excepting the period from 2nd December 1939 to 20th March 1940, when I officiated as Director of Agriculture, Bombay Province, Poona. During my deputation, Dr. G. S. Cheema, Horticulturist to Government, Bombay Province, Poona, officiated as Principal.

Dr. G. S. Cheema, Horticulturist to Government, Bombay Province, Poona, was on leave for 20 days from 20th May 1940 to 8th June 1940.

Mr. J. P. Trivedi, Professor of Agricultural Engineering, Physics and Mathematics, Poona, has been deputed for work at the Anand Agricultural Institution from 4th January 1940 and Mr. A. A. Vasavada, Lecturer in Agricultural Engineering has been appointed in his place.

Dr. V. G. Deshpande, Professor of Entomology was on leave for one month from 3rd October 1939 and is again on leave for four months from 26th June 1940.

Mr. K. S. Kulkarny, Assistant Professor of Agriculture, who was transferred to Dharwar as Deputy Director of Agriculture during the last year, came back to the College in his old post from 24th November 1939. He officiated as Professor of Agriculture from 2nd December 1939 to 20th March 1940 and was on leave for one month from 26th March 1940.

Mr. H. B. Kulkarni, Lecturer in Agriculture, acted as Assistant Professor of Agriculture in the vacancy of Mr. K. S. Kulkarny on deputation.

Mr. V. M. Chavan, Assistant Professor of Botany, has been transferred to Karjat as Crop Botanist to Government, Bombay Province, from 14th January 1940 and Mr. S. R. Godbole is acting in his place.

Mr. N. Narayana, Assistant Professor of Chemistry, was on leave for one month from 2nd October 1939.

Dr. M. K. Patel, Assistant Professor of Mycology, was on leave for two months from 6th April 1940 and Mr. M. N. Kamat acted in his vacancy.

There have been a few changes in the personnel of the subordinate staff of Lecturers and Demonstrators.

Equipment.

Library.—During the year the Library received the third instalment of Rs. 5,000 of the special grant.

365 new books were added. Among these special mention may be made of the Encyclopedia of Social Sciences and the new edition of the Indian Medicinal Plants by Kirtikar and Basu.

One more Journal was discontinued this year and three new and more useful ones were subscribed for. This brings the total number of periodicals regularly received to 93. Some back numbers of certain journals were also purchased.

The total number of books in the Library up-to-date is 8,425 only, and the number of complete volumes of periodicals is above 12,100.

The main work of giving call, author and accession numbers to each book was completed during the year. So also was the writing of the accession register completed and brought up-to-date. The typing of index cards, pasting of labels and writing numbers on them is in progress.

The Yeravada Prison Press authorities have kindly consented to accept 600 volumes per year for binding instead of the usual 300. This has speeded up the binding work and in the next three or four years it is expected that all the arrears in binding will be completed.

The following journals are being subscribed for by the various sections of the College and are sent to the library for being bound and preserved :—

Scientific Agriculture.
Sankhaya.
Botanical Review.
Botanical Gazette.
Chronica Botanica.
Biological Review.
American Journal of Botany.
Industrial and Engineering Chemistry (Analytical Edition).
Indian Journal of Economics.
Canadian Entomologist.
American Museum of Natural History.
British Mycological Society Transactions.

Laboratories.—The Government were also pleased to give the third instalment of Rs. 2,691 for equipping the various College Laboratories during the year under report. Out of this amount, Rs. 2,591 were utilised to equip the laboratories of the (1) Agricultural Engineering, (2) Chemistry, (3) Entomology, (4) Botany and (5) Plant Pathology sections and Rs. 100 sanctioned for the Agricultural Economics' Section were surrendered.

Curricula.

As mentioned in the last annual report, the college started its new session for the year 1940-41 from 1st May 1940 and the periods of the two terms have been extended by six weeks. Readjustment of the courses to give intensive practical training in Agriculture including Animal Husbandry and Dairying has been completed and the revised syllabus has been accepted by the Bombay University. The new course will come into force from the next academic year.

Studentship.

The number of students that attended during the year was as follows :—

Class.	First term.	Second term.
First Year in Science (Agri.)	85	89
Second Year in Science (Agri.)	63	65
Bachelor of Science (Agri.)	43	44
Total ..	191	198

Examination Results.

The result of the first, second and final year examinations are given in the following table :—

Examination.	Number appeared.	Number passed.	Percentage.
First Year in Science (Agri.)	94	60	63·8
Second Year in Science (Agri.)	75	65	86·6
Bachelor of Science (Agri.)	46	34	73·9

The percentage of successful candidates in the University examinations during the last three years is given below :—

Examination.	1938.	1939.	1940.
First Year in Science (Agri.)	50·0	69·6	63·8
Second Year in Science (Agri.) ..	87·3	70·0	86·6
Bachelor of Science (Agri.)	87·5	87·9	73·9

Post-graduate Courses.

In all 13 Post-graduate students were working in this College, namely—5 in Botany, 3 in Entomology, 3 in Chemistry, 1 in Horticulture and 1 in Plant Pathology sections. Of these, 1 was studying for Ph.D. degree, 4 for M.Sc. degree and 8 for M.Sc. (Agri.) degree.

Special Courses.

Special courses were taken advantage of by 12 students—Crop production 4, Veterinary 1, Horticulture 4, Entomology 1, Plant Pathology 1 and Chemistry 1.

Agricultural Graduates' Employment Board.

During the year 1939–40 there were 25 members on the roll of the Agricultural Graduates' Employment Board.

Six new members were registered during the year. To encourage a large number of graduates to become members of the Board, the amount of the fee has been reduced from Rs. 10 to Rs. 5. It is observed that many agricultural graduates are taking advantage of this concession.

During the year more than 13 enquiries for employment were received from the employing agencies, and these were promptly circulated to the registered members of the Board.

Dr. B. N. Uppal continued to work as Secretary-Treasurer of the Board and Dr. G. S. Cheema was a member of the Board.

Admission for 1940–41 for the Bachelor of Science (Agri.) Degree Course.

In all 98 duly qualified candidates (89 from Bombay Province and 9 from outside the Province) applied for admission to the First Year Class. But only 80 candidates (79 from the Bombay Province and 1 from outside) were admitted against the total of 80 in the last year. The educational standard of the new students admitted this year from the Bombay Province appears to be almost the same as that of the last year, as far as it could be judged from the percentage of marks secured by the students in the First Year Science Examination at various colleges.

College Uniform.

The uniform dress of khaki short and shirt for students was continued.

Post-graduate Degree Courses.

No student has been registered for the Post-graduate Course during the current session so far.

Special Courses.

Students have been admitted in the following courses :—

Subjects.	No. of students.
1. Crop Production	1
2. Plant Pathology	1
3. Dairy	3

Scholarships.

The number of scholarships for 3 years continued to be the same as in the previous year, viz.—5 for backward classes including Intermediate and Mohamedans and 3 for General Competition in each of the three classes.

The Students' Hostel.

During the year under report, there were 131 students in the first term and 111 in the second term. Seven clubs were working.

A unique feature this year was the holding of a common Hostel Day by all students, instead of separate individual club days as before.

Sports and Social Activities.

The College Gymkhana.—The Gymkhana continued its usual activities of outdoor and indoor Sports and athletics, the Students' Reading Room and the Debating Society. The Cricket, Football and Hockey departments had a very subdued time as the playground was under heavy repairs throughout the year. The ground is being brought into shape and it is hoped the above departments would be more active during the coming year.

The electricity installation done from Gymkhana Funds in the Hostel worked satisfactorily.

The Annual Social Gathering.—This was held in the third week of September 1939 when Mr. N. C. Kelkar presided and addressed the students.

Rovers.

During the year under report, there were 50 students as Rovers. Professor J. P. Trivedi was in charge of this movement. First Aid Classes were held and 20 students appeared for the First Aid Examination held by St. John Ambulance Association, Bombay. Of these it is gratifying to note that 16 passed and were awarded certificates.

The Rover movement is getting to be more and more popular among the students.

Students' Literary Activities.

The Poona Agricultural College Magazine.—Professor N. Narayana resigned from the staff editorship in the beginning of the year and his place was taken by Dr. J. A. Daji. The magazine continued to maintain a steady progress. There were in all 391 subscribers during the year as under :—

Students	..	..	..	..	219
Staff members	..	..	..	..	46
Others	..	..	..	..	126

Requests for free exchange of the magazine were received from a number of institutions both from India as well as from abroad. The total number of copies thus exchanged during the year was forty-three of which twenty-seven were with institutions in India and the rest with those in foreign countries.

The response from contributors especially from the students was very encouraging. Out of the total number of articles (29) published, a little less than half (12) was from the student contributors.

The financial position of the magazine has been very sound indeed. In spite of the increase in price of paper, etc., the magazine was able to add about Rs. 200 to the reserve during the year under report.

Students' Guardianship.

This has been discontinued.

The University Training Corps.

U. T. C. Platoon No. 6 of this college had full strength of one Officer, five N. C. Os., and thirty-one Cadets (including 60 per cent. trained men) by the end of June 1939. The plantoon had parades like last year every week with satisfactory attendance. In spite of the increased practical work at the College, the platoon kept up the high standard of efficiency winning the " best efficient platoon shield " of the " B " Company this year.

The credit goes to every member of the platoon.

The annual training camp was held at the Deccan College, Poona, from 22nd December 1939 to 5th January 1940. Our platoon stood first in the cross country race and won many other prizes such as—the Japanese race, the best selection cup, the best section leaders prize, etc.

Cpls. Fernandes, Joshi and L.-Cpl. Wagh passed with credit the lower certificate examination of efficiency qualifying for the Sergeant's rank. In the advance shooting course all trained cadets did well on the regular military range at Wanowri. Some members of

the platoon were selected for the Inter-Provincial U. T. C. Company Shooting league, but this was cancelled later on on account of war.

The members of the platoon trained up the forest rangers and the Special Bunding Class Students in drill and P. T.

The N. C. Os. training camp of the Battalion was held at the Fergusson College, Poona, from 3rd to 17th June 1940 and Cpl. Bapat, L. Cpl. Wagh and Cadet Argikar got special training as instructors.

Co-operative Stores.

The balance sheets for the years 1937-38 and 1938-39 were got prepared. In these two years the purchases and sales amounted to Rs. 10,484 and Rs. 12,029 respectively giving a net profit of Rs. 484. The number of members was 176. The accounts for the year 1939-40 are not yet ready as the year ends on 30th June.

Aid and Assistance to the Public.

Veterinary Hospital.—Apart from the main purpose of practical instruction to the students of the college, it has continued to help the public as in the past.

The number of in and out-patients during the year was 490 and 6,009 respectively as against 489 and 5,024 respectively in the previous year. The number of castrations performed was 202 and the number of cases supplied with medicines was 53.

Revenue Officer's Training Class.

As decided by Government in 1937, the revenue officers' training class was held for 12 days from 8th September 1939 to 19th September 1939 and 6 Assistant and Deputy Collectors attended the class.

Forest Rangers' Course.

Eight Forest Ranger Students—6 Bombay Government Nominees and 2 State Students—have completed their 2nd year's course during the year 1939-40 in the Forest Rangers' Training Class attached to the College. All of them have completed the course and have passed out successfully (6 Bombay Government nominees in Honours and the 2 State Students in Higher Standard).

The duration of the Forest Rangers' Training Class has been extended by another two years and accordingly the second batch has commenced work since 1st May 1940, and consists of 10 students—6 Bombay Government nominees, 2 Indian State and 2 private candidates.

Research and Advice.

This institution, in addition to teaching, also conducts research into various problems concerning agriculture and allied sciences which makes teaching at the College more realistic. Summaries of research work done by each section are embodied in the Annual Report of the Department. The Bee Keeping Research Scheme which was started in 1938 temporarily for one year is continued for another year. The work done by the Bee Keeping Expert during the year has been reported separately.

Visitors.

Following were the visitors during the year under report:—

1. Mr. P. M. Kharegat, C.I E., I.C.S., Vice-Chairman, Imperial Council of Agricultural Research, New Delhi.

2. Mr. Aza Nur Mahomed, Deputy Director of Agriculture, Afghanistan.

3. The Royal Consulate of Egypt, Bombay.

4. A demonstration on small scale was arranged at the College on 12th and 13th September 1939 for the local public workers and number of such workers visited.

5. Students of various local educational institutions and those of the Agricultural schools of Dhulia, Bijapur, Kolhapur and the students from the Allahabad Agricultural Institute and Surat Training College visited the College during the year.

Corruption.

There has been no case of corruption in the year under report.

B. S. PATEL,
Principal,
College of Agriculture, Poona.

College of Agriculture,
Poona, 30th July 1940.

Programme of work for the year 1940–41.

1. Administration and control over the teaching activities and welfare of the students of the College.

2. The readjustment and revision of the Post-Graduate courses to make them more useful.

B. S. PATEL,
Principal,
College of Agriculture, Poona.

College of Agriculture,
Poona, 30th July 1940.

APPENDIX E.

SUMMARY OF WORK DONE UNDER THE PROFESSOR OF AGRICULTURE, AGRICULTURAL COLLEGE, POONA, FOR THE YEAR 1939–40.

Charge.—Mr. B. S. Patel, I.A.S., held the post of the Professor of Agriculture during the year except from 2nd December 1939 to 20th March 1940 during which period he officiated as Director of Agriculture, Bombay Province, Poona. During this period Mr. K. S. Kulkarny officiated as Professor of Agriculture.

2. *Staff.*—Mr. K. S. Kulkarny who officiated as Deputy Director of Agriculture, Southern Division, till 17th September 1939, went on leave for 2 months from that date and re-joined as Assistant Professor of Agriculture from 23rd November 1939. Till this date Mr. H. B. Kulkarni continued to work as Assistant Professor of Agriculture and again officiated in this post from 2nd December 1939 to 20th March 1940 when Mr. K. S. Kulkarny officiated as Professor of Agriculture. Mr. K. S. Kulkarny proceeded on leave from 26th March 1940 to 25th April 1940 during which period Mr. B. S. Patel, Professor of Agriculture, held charge of the post. From 25th April Mr. K. S. Kulkarny has been working as Assistant Professor of Agriculture.

Owing to the greatly increased practical work in Agriculture, Government was requested to sanction 3 additional posts of Agricultural Overseers, one in the III grade, one in the II grade and a third in the I grade. These posts have been sanctioned for the year 1940–41. Mr. G. U. Patel, B.Sc. (Agri.), has been appointed in the III grade post. The filling in of the remaining two posts is under consideration. The delay in filling these two posts has caused very considerable inconvenience and very great ressure of work on the already hard worked staff and it is hoped this pressure will soon be relieved.

A. *Teaching.*

3. The unbalanced distribution of agricultural subjects (including Animal Husbandry and Dairying) has been remedied in the revised courses of studies which have been passed by the University of Bombay and this revised course will start from May 1941. The College terms have been changed and this year we have started the college work from the 1st of May instead of June 10th. The vacations have been cut down resulting in much larger number of term days with considerable increase in practical work in crops and animal husbandry and it is hoped this would result in sending out graduates with better training and having greater confidence in crop and animal management. The increased practical work in Agriculture given to 1st and 2nd year students has

been reflected in the results of the University examination in the subject of Agriculture as shown below :—

	Appeared.		Passed.	
	1938-39.	1939-40.	1938-39.	1939-40.
	Number.	Number.	Per cent.	Per cent.
F.Sc. (Agri.)	88	90	92	100
S.Sc. (Agri.)	46	70	80·4	95·7

4. *Special courses.*—Due to want of staff, the Special Course in Dairying and Animal Husbandry had to be stopped during the year under report. It has, however, been revised and revived since June 1940. We now offer two entirely practical courses in the year—one from June to November and the other from December to May. Already four students have joined since June 1940. There is an increasing demand for this course as applications are still being received.

The Crop Production course of one year given on the Agricultural College farm was continued during the year under report. Four students completed this course satisfactorily. Of these three were from the Bombay Province of which two were sent by the Anglo-Indian Community and one from Cutch State.

A large number of students from the local educational institutions such as the Training College for Men and Women at Poona, the Seva Sadan Society Training College, the N. M. V. High School, the Gwalior Rural Development Training Classes, Loni Basic Training College, Government Hand Weaving Institute and outside institutions such as the Agricultural Schools at Dhulia, Baroda, Devihosur and Kolhapur, Rishi Valley School of Madanpalle, the Allahabad Agricultural Institute, etc., were shown over crops, implements, etc., on the College farm and were given demonstrations on the production and handling of clean milk, etc., at the Agricultural College Dairy, Kirkee. A two days' special demonstration for the local public workers was also arranged but very few people took advantage of this.

5. *The College Farm.*—This institute continued its primary function of giving practical training in crop production, etc., to the College students and outsiders. It also gave all required facilities as regards land, labour, etc., to different research sections at the College in their research work. The museum of growing crops in the *Kharif* and *Rabi* seasons as also the implement museum were maintained. These museums were fully utilised by the students of this College and students of various educational institutions of Poona and other places. The Agricultural staff attended to the Agricultural and Dairy work in connection with the I.C.S. and other Revenue Officers' Training Class.

(*a*) *The Season.*—The season of the year under report was an exceptionally anxious one. The total rainfall was only 16·76 inches against a normal of 28 inches. The distribution of even this small quantity was very poor. April and May gave hardly any rain. The whole of June gave 2·15 inches over 12 days, on 7 of which the rain was between 2 and 4 cents only. Sowings of Kharif crops were postponed till the first week of July. The whole of July brought in 7 inches of rain on 24 days, on 11 days of which it was below 5 cents. This however, was not so bad. August was nearly rainless till past its middle and this caused very great anxiety for all dry crops. This anxiety was partly relieved by good rains from the 25th August but only to increase the uncertainty practically throughout September during which month the total rainfall was only 72 cents out of which the biggest fall was 21 cents, the remaining being under 10 cents on 12 days at intervals. October gave an inch and a quarter to start with and another inch and a half nearly in the third week. This rainfall was indeed very timely for *rabi* sowings. The rabi dry crops, however, had very unfavourable season. The result of these very unsatisfactory rains was that dry crops on the whole gave poor returns though far better than on the surrounding cultivators' lands and many acres had to be helped with canal irrigation.

The yields of some of the important crops per acre (lb.) were as under :—

(Italics means unirrigated.)

Dry crops.		Irrigated crops.	
1. Bajri ..	*980* grain.	1. Sugarcane—	
	2,152 fodder.	(*a*) P.O.J. 2878 (plant cane).	12,124 gul.
2. Nilwa jowar ..	*4,216* Dry fodder.		
	Dry fodder 11,548 Partly irrigated.	(*b*) C.O. 419 (plant cane).	13,926 gul.
3. Shalu jowar ..	*11,230* Green fodder.	(*c*) P.O.J. 2878 (ratoon).	9,732 gul.
4. Wheat Str. 808 ..	*1,594* grain. (After Suran).	(*d*) P.O.J. 2878 (Adsali).	10,020 gul.
		plus canes sold ..	22,735 (Numbers).

Dry crops.			Irrigated crops.		
5. Maize and Chavli ..	3,144	Green fodder.	2. Suran—		
6. Soya beans ..	337	Grain.	(a) Final year crop.	42,617	Corms.
7. Soya beans fodder ..	2,508	Green.	(b) 1st, 2nd, 3rd year crops.	13,992	Corms.
8. Groundnut—					
(a) Spanish Peanut ..	610	Dry pods.	3. Sweet Potatoes ..	9,752 19,112	Tubers. green fodder.
(b) Spanish Peanut ..	1,150	partly irrigated.	4. Wheat Pusa 4 ..	1,482	grain.
(c) Kopargaon I ..	1,165	partly irrigated.	5. Oats and Peas ..	24,284	green fodder.
(d) Kopargaon III ..	2,098	after Suran.	6. Oats for seed ..	1,236	grain.
(e) Big-Japan ..	1,808	partly irrigated.	7. Turmeric ..	17,961	green.
(f) Small Japan ..	708	partly irrigated.	8. Ginger and Yams	5,774 10,854	green ginger. Yams.
9. Linseed ..	34	seed.	9. Onions for bulbs.	35,400	Bulbs.
10. Chillies ..	317	dry pods.	10. Onions for seed ..	560	Seed.
11. Cotton—			11. Garlic ..	2,555	
(a) Jarilla ..	679	seed cotton.	12. Cucurbits—		
(b) 1027 A.L.F. ..	1,701	seed cotton (after sugarcane).	(a) (Kharif)Dudhia, Bhopla, etc.	11,404	
(c) B.D. 8 ..	1,532	seed cotton (after sugarcane).	(b) Rabi (November planting).	28,000	
12. Tobacco ..	944	Dry leaf.	13. French Beans ..	3,096	green pods.
			14. Lima beans ..	15,448 736	green pods. seeds.
			15. Double beans ..	10,766 926	green pods. seeds.
			16. Brinjal (Surti) ..	14,637	
			17. Cabbage ..	4,875	
			18. Tondli (12 months —First year).	27,080	Green fruits.
			19. Lucerne ..	33,380	green fodder.

B. *Research and Investigation.*

8. *Position of Legume and oil seeds in rotation with a cereal.*—The treatments compared were (*a*) *Bajri* after *Bajri* (BB), (*b*) *Bajri* after Soyabeans (BS), (*c*) *Bajri* after sesamum (B Ses), and (*d*) *Bajri* and *Tur* mixture year after year, (BT). This year's results show that BT is superior to all the other three treatments, BS is superior to B Ses and BB, and B Ses is superior to BB. The mean yields per acre are given below :—

				Per cent. increase over BB.
Bajri in the	BT	1,453 lb. per acre	..	62
,, ,, ,,	BS.	1,319 ,, ,, ,,	..	38·9
,, ,, ,,	B Ses	1,088 ,, ,, ,,	..	14·7
,, ,, ,,	BB	949 ,, ,, ,,	..	....

From the per acre financial point of view over a period of 2 years of the rotation, the following is the order of realisations per year :—

Treatment.	Order.	Value. Rs. a. p.
BT	I	97 2 0
BS	II	70 7 9
B. Ses.	III	56 4 0
BB	IV	35 4 0

9. *Manurial requirements of Brinjals.*—As the study of this crop during the years 1933 to 1936 showed that in the Poona medium black soils, nitrogen was the ruling element, since 1937 a study is being made in six replications as regards varying quantities of nitrogen, viz., 60 lb., 80 lb., 100 lb. per acre in the form of Sulphate of Ammonia in addition to a basic dose of 20 carts of Farm yard manure. The table below shows the average results for 1939-40 :—

Treatment.	Average yield per acre. (lb.)	Per cent. increase yield over control.
1. Farm yard manure only (Control) ..	8,840	..
2. Farm yard manure + 60 lb. Nitrogen ..	14,560	64·7
3. Farm yard manure + 80 lb. Nitrogen ..	15,704	77·6
4. Farm yard manure + 100 lb. Nitrogen..	16,744	89·6

The results show that addition of nitrogenous manures was significantly superior to Farm yard manure only. The different doses of nitrogen failed to show any significant difference amongst themselves. This result is in agreement with that of the last year.

10. *Effective rotting of sann hemp green manure.*—This experiment was started in 1937-38 to study the effects of adding F.Y.M. at the time of plowing in the green manure crop. The crops grown in the *rabi* season were (*a*) garlic and (*b*) tobacco.

(*a*) *Garlic.*

The results of garlic showed there was no significant difference between the treatments. The yields are given below :—

Treatment.	Yield per acre (lb.).	Per cent. increase over control.
(1) No manure	2,980·9	....
(2) Sann green manuring only	3,182·0	6·8
(3) Sann green manure *plus* 20 carts F.Y.M. ..	3,116·5	4·6
(4) F.Y.M. 20 carts only	3,846·5	29·0

(*b*) *Tobacco.*

The results of tobacco show that the whole experiment was not significant and there was no significant difference between any of the treatments. Besides the crop was very uneven due to drought. The yields by treatment are :—

Treatment.	Yield per acre dry leaf (lb.).	Increase over control.
(1) No manure	526·6	....
(2) Sann green manuring only	496·6	—5·7
(3) Sann green manuring *plus* 10 carts F.Y.M. ..	625·4	+19·0
(4) F.Y.M. 10 carts only	719·4	+36·7

11. *Onionised versus non-Onionised water.*—In order to test on a field scale the effects of irrigating a crop with water passing through a bed of onion plants, cabbage was grown and irrigated with and without onionised water. This trial was laid in 6 replications in the students' method. The results showed that whereas ordinary water irrigation gave an yield of 6,508 lb. of cabbages, onionised water gave an yield of 5,576 lb. of cabbages. This experiment will be repeated for another two years.

12. *Effects of different kinds of tillage with and without farm-yard manure on dry crops in the Deccan.*—This is the ninth year of this study intended to find out what difference in yield it would make if as preparatory tillage, annual ploughing, etc., is done as against only harrowing. Jarilla cotton and *Nilwa jowar* for grain were grown during the year.

(*a*) *Cotton Jarilla.*

The results show that addition of farm-yard manure either with ploughing or with harrowing is superior to no-manure plots as in the previous year. Between themselves these show no significant difference. There is no significant difference between ploughing and harrowing as preparatory tillage.

(*b*) *Jowar.*

The results under this crop are on the same lines as under cotton.

13. *Improvement of soil fertility by leguminous crop green manuring as against growing and cutting of the leguminous crops.*—An experiment was undertaken this year to study the relative difference in soil fertility that would be obtained by actually green-manuring a leguminous crop as against growing that crop, cutting off the above-ground parts and allowing only the underground parts to rot in the soil. Sann hemp was the leguminous crop grown. The crop to follow was peas and oats for green fodder. The experiment was laid out in 6 replications in the A B B A method. The cut-off material was used for composting.

The soil analysis for Nitrogen just before the sowing of the following crop showed as below :—

	Whole plants buried in (percentage).	Only stubbles buried in (percentage).
Nitrogen (average of 6 tests) ..	0·093	0·086

The yield of green peas and oats fodder was as below :—

	Lb.	Lb.
Green fodder per acre ..	22,564	18,624

The increase of 21·1 per cent. in favour of the green-manured plots is however, not significant.

8,151 lb. of the Cut Sann material obtained from 30 gnnthas of land was mixed with 5,432 lb. sugarcane trash and composted. The compost turned out came to 4,053 lb.

14. *Development of higher milk yield, along with early maturity and regular calving in Sindhi cows and Surti buffaloes—*

(*a*) *Sindhi cows.*

(*i*) In the line of out-crossing with bull Tulip, there were six of his daughters in milk, two of which have shown their superiority over their dams. One of these Tucas No. 053 has stood first in the whole herd giving a record of 5,567 lb. of milk as an annual average of 7 completed lactations as against the herd average of 3,004 lb.

(*ii*) Two daughters of the bull Silver Jubilee were in milk in the year under report but they have not completed their lactation.

(*iii*) This year also the performance of the daughters of King Canute was poorer than the last year.

(*b*) *Buffaloes* (*Surti*).

The performance of the Surti Buffaloes of different pedigree lines is given in the statement below :—

Performance of the Buffaloes of the different pedigree lines.

Serial No.	Name of the daughter.	Annual average milk yield in lb.	Number of lactations.	Name of the dam.	Annual average milk yield in lb.	Number of lactations.
	I. Inbreeding of Bhagi Line by bull Dairy Butter.					
1	Bhagter I ..	4,547	5	Bhagi	4,709	5
	II. Line Breeding of Bhagi by bull Baxi.					
1	Bhixi	3,929	7	Bhagi	5,131	7
2	Bhagaxi	3,898	4	Bhagabai	3,187	4
	III. Line Breeding of Sexta by bull Dairy Butter.					
1	Suxter I	3,281	6	Sujex	4,656	6
2	Suxter II ..	3,180	1	Sujex	2,608	1
3	Sujecter ..	4,641	2	Sujecta	3,879	2
	IV. Line Breeding of Sexta by bull Dairy Pride.					
1	Sabdip	3,810	5	Saber	4,522	5
2	Sabapride ..	4,339	3	Saber	4,465	3
3	Prasab	3,188	4	Saber	4,350	4
	V. Line Breeding of Sexta by bull Sabapran.					
1	Ghosran ..	4,434	3	Gondip	3,832	3
2	Mathran	3,566	2	Motide	2,528	2
3	Lafran	3,235	3	Lafter	3,887	3

Some of these animals are extremely valuable for breeding high-yielding buffaloes.

C. Commercial Working of the College Dairy.

15. The working of the year under report is summarised as below :—

Table No. I.

The strength of the herd during the year stood as under :—

Kind of live-stock.	Opening.	Closing.
Cows ..	28	33
1. *Female*—		
Yearlings	3	11
Below 2 years	10	2
Below 3 years	7	5
Above 3 years	2	1
2. *Male*—		
Yearlings	11	15
Below 2 years	6	....
Below 3 years	1	4
Above 3 years	4	1
3. *Breeding Bulls*	3	2
Buffaloes ..	82	62
1. *Female*—		
Yearlings	15	8
Below 2 years	11	10
Below 3 years	12	11
Above 3 years	3	11
2. *Male*—		
Yearlings	19	18
Below 2 years	1	....
Below 3 years	2	....
Above 3 years	1	2
3. *Breeding Bulls*	3	4
Bullocks ..	30	24
Total ..	254	224

Table No II.

16. *Performance of Animals.*

Year.	Cows.		Buffaloes.		Average yield per head.			
					Cows.		Buffaloes.	
	Milking.	Total dry and milking.	Milking.	Total dry and milking.	Actually drawn.	After feeding calves.	Actually drawn.	After feeding calves.
					lb.	lb.	lb.	lb.
1938-39.	21·6	28·0	68·3	82·2	2,625	2,150	3,550	3,367
1939-40.	24·3	30·0	53·5	71·2	3,004	2,648	3,138	2,967

Table No. III.

17. The financial aspect of the year 1939–40 as compared with the year 1938–39 :—

Year.	Total quantity of milk produced in lb.	Milk fed to calves in lb.	Milk available for disposal in lb.	Cost of 100 lb. of milk available for disposal.	Realisation per 100 lb. of milk.
				Rs.	Rs.
1938-39 ..	351,386	28,413	322,973	15·70	13·10
1939-40 ..	315,064	24,662	290,402	14·55	13·13

The decrease of Rs. 1·15 in the cost of production is probably due to the more uniform performance of the milking stock in general. The discarding of a number of less productive buffaloes has also helped to bring down the general feeding cost.

The total area under fodder crops was 259 acres as against 235 acres of last year. 67 acres were cropped twice as against 51 acres in the previous year. The total fodder produced during the year came to about 41 lacs of lb. as against 39 lacs lb. of green fodder in the previous year. The cost of fodder production worked out at Re. 0–5–5½ per 100 lb. green fodder as against Re. 0–5–10½ in 1938–39. The decrease is mainly due to slightly lower cost of establishment charges and a little more intensive cultivation.

The rainfall in this year was too poor at Manjri and this gave very little grazing at the Manjri Kuran.

Bull services.—The College Dairy afforded during the year under report services of the bulls to 34 cows and 16 buffaloes of the public.

D. Aid and Assistance.

18. *Help to different sections of the College.*—The College farm provided eight acres to the different sections of the College and the Agricultural Meteorologist for their research work. All other help was also given. Eight good young buffalo bull-calves were given to the Live-Stock Expert for being used in the Buffalo Improvement Scheme in Gujarat.

19. *Visitors.*—Over 500 visitors were shown various sections of the Agricultural College Farm and the Agricultural College Dairy. Of these, special mention might be made of Sir D. B. Cooper, Professor Warner of Allahabad, Rao Bahadur Sivan of Madras, the Honourable Consul to the Egyptian Government and the Deputy Director of Agriculture, Afganistan.

19A. *Enquiries.*—Over 700 enquiries on various topics relating to crops, manures, implements, seeds, milk and milk products, cattle feeding, etc., were all attended to.

There were no cases of corruption among the members of the staff. The staff worked very hard and gave excellent co-operation.

B. S. PATEL,

Professor of Agriculture.

Programme of Work for the year 1940-41.

1. *Teaching.*—This would be continued on the lines mentioned for the year under report.

2. *Research.*—The following items of work will be in hand during the year :—

(*i*) Position of legume and oil-seed in rotation with a cereal.

(*ii*) Effective rotting of sann hemp green manure.

(*iii*) Effects of different kinds of preparatory tillage with and without manure for dry crops in the Deccan.

(*iv*) Improvement of soil fertility by leguminous green-manure crops.

(*v*) Modified method of planting sugarcane.

(*vi*) Onionised *vs.* Non-onionised water for cabbages.

(*vii*) Trial of napier grass on " Mal " land.

(*viii*) Spacing and Varietal trials of 1027 A.L.F, B.D.8, and Segregate 1-6.

(*ix*) Spacing experiments on Sankeshwar and Local chillies.

(*x*) Development of higher milk yield in cows and buffaloes along with early maturity and regular calving.

B. S. PATEL,

Professor of Agriculture.

APPENDIX F.

Summary of the Work done under the Plant Pathologist to the Government of Bombay, Poona, for the Year 1939-40.

Dr. B. N. Uppal held charge of the section throughout the year.

In order to relieve Dr. Uppal of the routine office and account work to enable him to devote more time to research, Government have created a special temporary post of Assistant to the Plant Pathologist to Government and appointed Mr. M. N. Kamat to it. Mr. V. P. Bhide has been appointed Assistant Mycologist in place of Mr. Kamat.

Dr. M. K. Patel, Assistant Professor of Mycology, was on leave for two months from April 6 to June 5, 1940 and Mr. M. N. Kamat acted for him in addition to his own duties as Assistant to the Plant Pathologist to Government.

Mr. M. K. Desai continued to work as Assistant Plant Pathologist under a temporary scheme of research on the koleroga of areca nut with headquarters at Sirsi. Additional staff has been provided by Government.

Mr. P. M. Varma and Dr. S. P. Capoor joined their duties as Assistant Entomologist and Agricultural Overseer, respectively, under the Bombay Virus Diseases Scheme.

Mr. S. P. Chaudhari was appointed Sann Investigator in place of Mr. V. P. Bhide under the scheme of research on wilts in sann hemp and *Lathyrus sativus* financed by the Trustees of the Sir Sassoon David Trust Fund.

Mr. J. D. Ranadive and Mr. Y. S. Kulkarni continued to work as Pathological Assistants on the Cotton Wilt Breeding Scheme, Poona. Mr. S. P. Shah worked as Pathological Assistant on the Cotton Wilt Breeding Scheme for the Surat Area, with headquarters at Hansot near Ankleshwar.

Mr. S. V. Pingale was appointed Assistant under the scheme for cereal rust investigation, with effect from October 1, 1939. Mr. Pingale resigned the post on December 22, 1939, as he was appointed Lecturer in Entomology. Mr. M. V. Pandit was appointed in his place.

I have also to note that no cases of corruption on the part of Government servants under my control came to my notice during the year.

Education.

The Plant Pathologist to the Government of Bombay was assisted by the Assistant Professor of Mycology and the Assistant Mycologist in connexion with the teaching of plant pathology and agricultural bacteriology.

A special lecture demonstrating the diseases of crop plants and their methods of control was delivered to the Civilian class held during the year.

A number of students applied for admission to the post-graduate course in plant pathology but were refused admission as the members of the staff were fully occupied with the large and heavy programme of research work undertaken by the section. There was one special and two post-graduate students engaged in research.

Research.

1. *Fusarium wilt in sann hemp.*—The work on the relative pollinating efficiency of *Apis* and *Megachile* bees was continued during the year. In laboratory tests 500 Apis-stimulated seeds and the same number of Megachile-stimulated sann hemp seeds were germinated in petri dishes to determine the differences in the germinability of the two kinds of seed, as it was recognised that the seed produced as a result of stimulation of flowers by *Apis* bees might give lower germination due to self-fertilisation taking place. The results showed, however, that there was no marked difference in the germination of the Megachile- and Apis-stimulated seeds, the percentage of germination being 90·75 in the former case and 88 in the latter.

In another test about 500 seeds each of the above two types were sown in the field to see whether the resulting plants show difference in vigour and yield. There was no difference in the growth and vigour of the two crops, although the Megachile-stimulated plants produced, on an average, 13·25 pods per plant whilst pollination by *Apis* bees gave a yield of about 11 pods per plant.

The fresh crosses of D-IX with homozygous susceptible individuals were tested in August, 1939, in infected soil in soil temperature tanks maintained at 26–27°C. Only 27 plants completely wilted out of a total of 133, whilst the remaining ones showed external symptoms of wilt and gave fungus on isolation. This showed that the strain of the fungus used in these experiments had partially lost its virulence. A test made to determine whether the strain was still actively virulent gave 55 per cent. wilting in susceptible individuals grown in infected soil. Fresh isolates of the wilt organism have been obtained and are being tested for their virulence.

Fifty-three plants of the F_1 were grown separately in the field and sib-pollinated to obtain F_2. The F_1 were also back-crossed to D-IX parent. These will be tested further next year.

A cage of 10-mesh galvanised wire-netting, measuring 50′ × 20′ × 9′, was constructed at the College Farm for multiplication of the wilt-immune strain D-IX. The sib-pollinated seed was sown in this cage on August 22, 1939. The date of sowing was prolonged this year with a view to evading the heavy rains in September, which are usually received during the flowering period of the crop if sown earlier in the season.

When flowering had started, *Megachile* bees were let into the cage after the usual treatment to free them of foreign pollen. The crop was quite good and 6 lb. of seed was harvested.

Two hundred and fifty pounds of open-pollinated seed obtained from the crop grown last year on the Dharwar Farm was again grown there for multiplication. The crop was in a good condition and free from insect attack. Four thousand and three hundred pounds of seed was harvested.

A small quantity of the open-pollinated seed was tested in the infected soil in soil temperature tanks maintained at 26-27°C. to ascertain the amount of contamination due to cross pollination. Of 150 plants tested, 4 died of wilt and gave *Fusarium* on isolation. This shows that a small amount of contamination had taken place.

Periodic sowings of sann hemp from October 1938 to February 1939 have shown that an average crop of sann hemp can be grown if sowing is done between June and December; but later sowings do not yield any seed and the crop remains stunted.

2. *Wilt in Lathyrus sativus.*—As reported last year, the five varieties of *Lathyrus sativus* received from Indore were tested in wilt sick soil at Poona. The seeds of the best plants among the survivals were grown in the infected plot during the year. The progenies of the selected plants of the two promising varieties, viz., Type 1, plant 37 and Type 148, plant 2, which did not suffer mortality from wilt in 1938, segregated and showed infection ranging from 0 to 45 per cent and 0 to 6·6 per cent, respectively. The progenies of selected plants of the other two varieties, viz., Type 1, plant 2 and Type 6, plant 3, also showed a high degree of infection. The district collections and the selections made at Poona were also not free from wilt. Selections have been made in all types, and the seeds of those plants that have not suffered mortality from wilt during two seasons will be tested in pot culture.

The experiment on the relation of soil temperature to development of wilt in *Lathyrus sativus* was continued. It was found that at a soil temperature of 27°C. wilt is most virulent and early to appear. The severity of infection decreases and the incubation period increases with rise in soil temperature until at 37·5°C. there is no wilt. These results agree with those of last year.

The fungus was grown on a variety of synthetic and vegetable media. The following is a short account of its characteristics :—

Microconidia scattered freely in the mycelium but never in pinnotes, mostly one-celled, ovoid or ellipsoid, constituting 80 to 90 per cent of the total numbers of spores. Macroconidia few, not produced in any synthetic medium, produced in a few vegetable media, fusiform, nearly straight with no pedicel, septa inconspicuous, walls thin. No sporodochia produced in any medium or on *Lathyrus sativus*. Conidiophores simple. Stroma not erumpent, non-pigmented on potato-dextrose agar, cinnamon brown on oat-meal agar, madder violet on rice.

Chlamydospores numerous, terminal and intercalary, in conidia, single or rarely double, spherical, smooth.

Sclerotia wanting.

The fungus causes vascular wilt in *Lathyrus sativus* L.

The presence of terminal and intercalary chlamydospores, abundant 1-celled, ovoid microconidia, and delicate walls and inconspicuous septation of the conidia would place this fungus in the section Elegans of the genus *Fusarium*. Further, the absence of pinnotes and sporodochia, colour of stroma, simple conidiophores and smooth plectenchyma would refer the fungus (of which the macroconidia are mostly 3-septate and measure $30 \times 4\,\mu$) to *Fusarium orthoceras*. Pathogenicity trials on hosts of *F. orthoceras* would finally determine whether the wilt organism of *Lathyrus sativus* belongs to this species or is a variety of it.

3. *Powdery mildew of betel vines.*—During the year demonstrations of methods of control of powdery mildew by dusting betel vines with finely powdered sulphur were made at Bassein, Kelva and Mahim. One application of sulphur was made in new gardens, but two dustings were given at intervals of 1½ months in old plantations. The demonstrations were a great success as the mildew was effectively controlled by dusting.

4. *Koleroga of areca-nut.*—The work on the carry-over of the causative organism of koleroga has confirmed the previous year's results. Throughout the dry season, the fungus (*Phytophthora arecae*) could be readily isolated from the dead or dying tops of areca-nut; in some cases profuse mycelial growth was seen on splitting open the affected tops. All attempts to secure the fungus from the diseased nuts of the previous season have failed. On the other hand soil at the base of the trees known to have been severely diseased in the previous season has readily yielded the organism in pure culture. What part, if any, this soil infestation plays in the annual recurrence of the disease is not known at present.

There is a belief among the arecanut growers that during the monsoon the disease invariably starts from certain centres in a garden and these growers also discriminate certain trees in a garden as being responsible for initiating primary infection. This belief has now been shown to have a scientific basis since the trees suspected of being the main source of primary infection are those that carry latent infection in their tops without showing any outward symptom of the disease in the dry season. At first it seemed that this source of primary infection would prove very difficult to deal with, but a method has now been devised by which the trees harbouring latent infection in tops can be distinguished. There is also some evidence that the fungus spores are not carried long distances by the wind. These observations would show that the removal of the sources of infection before the commencement of the monsoon supplemented by the spraying of only such trees as harbour latent infection in tops early in the rainy season should provide an effective method of keeping the gardens free from infection. The Government have now sanctioned a scheme to test the value of these observations in the control of koleroga, and work has already commenced in an area of 25 acres of areca nut.

Spraying trials to test the relative merits of different adhesives have shown that casein and Lethalate Wetting Fluid are better than resin-soda and Agral. These results, however, need further confirmation.

Perenox, a proprietary fungicide, did not prove as effective as Bordeaux mixture in the control of " koleroga " of areca nut.

5. *Damping-off in tobacco seed-beds.*—Experiments on the control of damping-off of tobacco seedlings were continued at the Tobacco Breeding Station, Nadiad. Bouisol, Perenox and Cheshunt compound were the fungicides used for the disinfection of soil in seed-beds. Bouisol and Perenox are proprietary compounds and were used in strengths of 2 oz. of the former in 5 gallons of water and 2½ lb. of the latter in 50 gallons of water. The fungicides were applied to the beds at weekly intervals with a pressure sprayer. The first spray application was made after the emergence of seedlings and in all seven sprayings were given. Perenox of the strength 2½ lb. in 50 gallons of water produced considerable amount of spray injury of seedlings, and was subsequently replaced by a weaker concentration of 1 lb. in 50 gallons of water.

Records were made of the total numbers of seedlings damped off and the total areas of seed-bed damaged by the disease in the different treatments. Taking 100 as the number of seedlings damped off in the control beds, the number of diseased seedlings in the seed-beds treated with Bouisol, Perenox and Cheshunt compound amounted to 2 per cent, 2·4 per cent, and 23·4 per cent, respectively.

6. *N-fixation by Azotobacter.*—*Azotobacter*, grown in Ashby's solution in association with the living roots of raddish, wheat, rice and jowar, is able to fix larger amounts of nitrogen than in the absence of such association. When *Azotobacter* is grown in Ashby's solution, the amounts of nitrogen fixed are directly related to the periods of growth of the organism in culture ; but after a definite period of time (this period varies with the temperature at which the cultures are kept) the nitrogen-content of the culture medium begins to fall off. At higher temperatures, say 27°C, cultures of *Azotobacter* in Ashby's solution fix the maximum amounts of nitrogen in a shorter time than at lower temperature, say 20°C. The addition of small quantities of mohua (*Bassia latifolia*) flowers and of molasses to the cultures of *Azotobacter* greatly increases its ability to fix atmospheric nitrogen.

7. *Soft rot of ginger.*—*Pythium myriotylum*, the causative organism of the soft rot of ginger, has been studied in culture. The present method of growing ginger in beds favours the development of soft rot due to the accumulation of water in the upper layers of the soil. Experiments have been laid out to test the value of growing ginger on broad ridges with a view to keeping soft rot in check.

8. *Fig rust.*—Experiments on the value of Sulsol in the control of fig rust were continued during the year. The fungicide was applied in the strength of 2 lb. of Sulsol in 100 gallons of water. The experiment was again inconclusive as no rust appeared during the season.

9. *Panama disease of bananas.*—Varietal trials of bananas were conducted in infected soil at Rajuri near Ale. Alternate rows of *Basrai*, *Kali* and *Soni* (a highly susceptible commercial variety) were planted in wilt

sick soil in May 1939. By the middle of August, all *Soni* plants were dead and there was no infection in *Basrai*, but there were a few doubtful cases of infection in *Kali*. The causative organism, *Fusarium oxysporum cubense*, was isolated from dead *Soni* plants.

Arrangements have been made to carry out large-scale trials with *Basrai* in the next season.

10. *Rust on chrysanthemum.*—Chrysanthemum rust caused by *Puccinia chrysanthemi* broke out in an epidemic form at Walhe near Poona. The rust usually appears at the bud stage and becomes destructive by the time the flowers are opened. Experiments on control were undertaken in two plantations at Walhe, and two spray applications of Bordeaux mixture 3-3-5 and Bouisol (3½ lb. in 100 gallons of water) were made with a pressure sprayer at intervals of a fortnight. The rust was effectively controlled, although the plants treated with Bordeaux mixture looked better than those sprayed with Bouisol. None of the fungicides produced any spray injury of the flowers.

11. *Black spot of mango.*—As reported some time ago, a new species of the monotypic genus *Actinodochium* was isolated from black specks on ripe *Alphonso* mangoes collected at Vengurla. The fungus was unable to penetrate the uninjured skin of the mango fruit but easily invaded it when entry was facilitated through a wound.

12. *Bacterial leaf-spot of Desmodium.*—A bacterial-leaf spot of *Desmodium diffusum* was observed on the College Farm at Poona. A yellow organism was isolated from the spots in pure culture and has proved pathogenic on its host. In cross inoculation trials the organism did not infect any of the large number of legumes tested. It appears to be a new variety of *Bacterium phaseoli.*

13. *Twig blight and fruit rot of mango.*—Histological studies of the artificially affected mango stems have shown that the fungus can penetrate the unbroken cuticle and that pycnidia develop subepidermally from a mass of mycelial threads. The hyaline pycnospores vary in length from 16·5 to 26·1 μ and in width from 4·8 to 6·9 μ. As the fungus has large conidia, over 15 μ long, it may be considered a *Macrophoma* since the fungi having spore less than 15 μ in length are usually referred to the genus *Phoma*. However, this distinction between *Phoma* and *Macrophoma* is entirely unsatisfactory, and the fungus on mango has therefore provisionally been classed as a *Phoma* (?).

14. *Cotton Wilt Breeding Schemes.*—The following is a brief summary of the work done during the year.

(I) BROACH SECTION.

(*a*) *B.D. 8.*—Progenies of 18 plants of 5 cultures of B.D. 8 were further tested under conditions of optimum infection in 1939-40. None of the cultures is yet completely free from wilt, although there is evidence that some cultures, viz., B.D.8-B_4 and B.D.8-B_7 will ultimately attain homozygosity for 100 per cent wilt resistance. Further testing will be continued.

(*b*) *N.S. 12.*—Progenies of 16 plants comprising 7 cultures, which showed less than 10·5 per cent wilt in 1938–39, were selected for testing in 1939–40 in the glasshouse. The cultures are still highly segregating. Further tests will be continued.

(*c*) *B.D. 8 and N.S. 12 crosses and back-crosses.*—The cross (B.D. 8 × G.A. 26) F_6 is still not homozygous for 100 per cent wilt resistance as the progeny of one of the two plants under test gave a slight mortality of 1·2 per cent. Further test will be continued.

The back-cross, (B.D. 8 × G.A. 26) × B.D. 8, continues to show a very high degree of wilt resistance, the maximum mortality obtained in any one culture being 2·9 per cent; some cultures were free from wilt. There is every indication that 100 per cent wilt resistant cultures will be obtained in a short time.

The cross (B.D. 8 × N.S. 12) and the back-cross with B.D. 8 are showing a very high degree of wilt resistance, the highest mortality in any one culture being 2·9 per cent. This material is rapidly approaching homozygosity as regards 100 per cent resistance.

(*d*) *N.S. 49.*—The cultures are still segregating although they show a high degree of wilt resistance.

(*e*) *Russian herbaceums.*—The culture 2761–1 continues to be completely free from wilt. The material will now be transferred to the Cotton Breeder, Broach.

(*f*) *District collections.*—Some of the 10 collections retained for further study last year are showing high resistance. The material, however, resembles B.D. 8 in boll and other characters, and it is not worth while to continue further testing.

(*g*) *Fresh material.*—The cross (B.D. 8 × S. 7-1) F_5 and the back-cross, {(B.D. 8 × S. 12-1) × B.D. 8} F_3, show almost complete resistance to wilt.

The Cotton Breeder, Broach, has supplied more material of the cross (B.D. 8 × G.A. 26) F_8 and its back-cross with B.D. 8 in F_6 for further tests in the glasshouse at Poona. Two cultures of the back-cross have been retained for further study.

(*h*) *Study of wilt inheritance.*—The F_1's of the cross, K. F. (100 per cent resistant) × 1027 (highly susceptible), and its reciprocal were tested in soil temperature tanks maintained at about 26° C. The F_1 gave a mortality of about 19 per cent. in both cases. Wilt resistance seems to be governed by multiple factors.

(II) JALGAON SECTION.

(*a*) *Million Dollar.*—This strain has been under study since 1935–36 when it gave a mortality of about 3·8 per cent when tested in pot culture. The cultures tested last year suffered no mortality from wilt and have behaved similarly in the tests carried out during the current season although the resistant plants still show the symptom of leaf mottle. The strain has now attained homozygosity for 100 per cent wilt resistance.

(*b*) *New Million Dollar.*—This strain has continued to maintain its character of complete resistance to wilt and may now be considered to have attained homozygosity for 100 per cent wilt resistance.

(*c*) *Chinese R_1 Spotless* 51.—This strain, which originally gave a mortality of 53·4 per cent, is now completely resistant to wilt and has behaved as 100 per cent wilt-resistant for two seasons. This strain may also be considered to have attained homozygosity.

(*d*) *Crosses.*—The F_1's of the crosses of Jarila × New Million Dollar and Jarila × Chinese R_1 Spotless 51 were tested in pot culture and remained free from wilt but showed leaf mottle. The F_2 seed of the cross Jarila × Chinese R_1 Spotless 51 will be sent to the Cotton Breeder, Jalgaon, for further study. The cross Jarila × New Million Dollar is already under study at Jalgaon.

(*e*) *Study of wilt inheritance.*—The F_1's of New Million Dollar (100 per cent resistant) × Dhulia 2 (100 per cent susceptible) and its reciprocal were tested in soil temperature tanks and gave a mortality of 18·2 per cent and 24·6 per cent, respectively. Wilt resistance in this case, as in the herbaceums, seems to be governed by multiple factors.

(III) SURAT SECTION.

{(B.D. 8 × 1 A.L.B.) × 1027 A.L.F. } F_6.—Thirty-two cultures of this cross were grown at Shera, and of these three cultures, viz., 19, 25 and 31 have not suffered mortality from wilt. Culture 19 appears to be the best, but trials will be continued for another season to verify its superiority over the other two cultures.

{ [(1027 × { (B.D. × N.S. 12) × 1027 }] × B.D. 8-B_3 } F_2.—Eleven cultures were grown at Shera, of which only one culture was resistant to wilt ; but this culture does not possess either high ginning or good staple. It is proposed to discontinue further study of this cross as still better material is available from other crosses.

Selections from 1027 A.L.F.—The progenies of 12 plants selected last year as being free from wilt were grown at Shera. Of these, three cultures did not suffer mortality from wilt ; but only two cultures, viz., 63-36 and 66-27, which possess better agricultural characters than the third culture, have been retained for further study.

Selections from the district material.—It is proposed to reject all the three selections as they are short-stapled.

(8-1 × K.F.) *cross.*—The F_1 was grown in wilt sick soil at Shera. None of the plants suffered mortality from wilt nor was there any evidence of partial wilting. The F_1 is therefore highly wilt-resistant.

(8-1 × N.S. 12) *cross.*—It is proposed to discontinue work on this cross as a higher ginning and better staple material is under study in (8-1 × B.C. 1-6) cross.

(8–1 × B. D. 8) *cross.*—The F_1 was grown in wilt sick soil at Shera. None of the plants suffered mortality from wilt although there was some partial wilting evident in about 5 per cent of plants. The cross will be further studied.

[8–1 × {(B. D. 8 × G. A. 26) × B. D. 8} F_6–1–6] F_1.—This cross was grown at Shera, and the mortality was 0–8 per cent only ; 2·8 per cent plants showed partial wilting. Further work will be continued.

[1027 × {(B. D. 8 × G. A. 26) × B. D. 8} F_6–1–6] F_1.—This cross was grown in wilt sick soil at Shera. None of the plants suffered mortality from wilt, but there was a high percentage (45·7 per cent) of partial wilting. Further work will be continued.

[(B. D. 8 × G. A. 26)×B. D. 8] F_7.—This material was grown at Shera for using as a parent in crossing. As we have now available at Poona a 100 per cent. wilt-resistant race of segregate 1–6 of this cross, the cultures of the same segregate under test at Shera will no longer be maintained.

(8–1 × 1027 A. L. F.) F_5.—Fourteen plant progenies were grown at Shera, and of these three showed no mortality and very little of partial wilting. Further study will be continued.

Seg. 8–1.—One selection made from segregate 8–1 was tested and found to be highly wilt-resistant. Further work will be continued to see whether it maintains its resistance.

15. *Virus Diseases Scheme.*—The following virus diseases of plants were collected during the year and the viruses have been brought into culture in living plants grown in the glasshouses :—

(*a*) *Yellow vein-mosaic of Hibiscus esculentus.*—Virus not sap-transmissible but readily transmitted by *Bemisia gossypiperda* and by grafting.

(*b*) *Yellow mosaic of Phaseolus lunatus.*—Virus transmitted by *Bemisia gossypiperda.*

(*c*) *Indian bean mosaic.*—Virus sap-transmissible. Enations produced on lower surface of leaves.

(*d*) *Rugose mosaic of tomato.*—Virus transmitted by inoculation of expressed juice and by *Bemisia gossypiperda.*

(*e*) *Mosaic of Datura alba.*—Virus sap-transmissible.

(*f*) *Duranta enation mosaic.*—Transmission not yet known.

(*g*) *Phyllanthus mosaic.*—Transmission not yet known.

(*h*) *Rosette of Cassia tora.*—Virus transmitted by *Bemisia gossypiperda.*

(*i*) *Sunflower mosaic.*—Virus transmitted by inoculation of expressed juice but percentage of infection low.

Experiments on the transmission of yellow vein-mosaic virus of bhendi.—In feeding experiments, *Bemisia gossypiperda* readily transmitted the virus of yellow vein-mosaic of bhendi (*Hibiscus esculentus*). The disease developed as a rule in two to three weeks after the infective white-flies had fed on healthy plants. During summer months the incubation period of the disease was as short as nine days.

The white-flies became infective after they had fed on diseased plants for 2 hours and were then able to transmit the virus when confined on healthy plants for the same period. The minimum number of infective white-flies able to produce 100 per cent. infection in *bhendi* plants was 10, although in some feeding experiments even one infective white-fly transmitted the virus.

Hollyhock plants, *Althaea rosea*, serve as an alternate host of yellow vein-mosaic virus.

Physiological studies on yellow vein-mosaic virus.—Preliminary experiments were made on the relation of mineral nutrition to the susceptibility of *bhendi* plants to yellow vein-mosaic. Inoculation was done by confining about 20 infective white-flies on individual plants for 72 hours. Susceptibility was measured by determining the time required by the virus to reach young leaves and produce clearing of veins or chlorosis. The experiments have shown that plants receiving a complete nutrient were more susceptible than those fed on nutrient solution containing no nitrogen, phosphorus or potassium.

Leaf-curl in chillies.—Experiments done during the year have established that leaf curl in chillies is not of virus origin but is produced by the feeding of thrips, *Scirtothrips dorsalis*, on the young leaves of the plant. The disease could not be transmitted either by the inoculation of expressed juice of affected plants or by grafting.

16. *Wheat Rust Scheme.*—Two glasshouses, one at Mahableshwar measuring 42 feet × 15 feet and the other at Poona measuring 35 feet × 15 feet, are being constructed for work in connexion with the testing of seedling reactions of wheats to different races of black rust. A combined office and potting house has also been built at Mahableshwar. Work on the scheme will begin in November 1940.

Advisory Work.

A large number of enquiries on plant diseases were, as usual, dealt with during the year, and advice was given promptly whenever required. These enquiries have been steadily increasing during the past few years.

A special grant of Rs. 3,000 was made by Government for continuing demonstrations of methods of control of mango hoppers and mildew. These demonstrations were carried out in specially selected gardens at Vengurla, Belgaum and Dharwar in the Southern Division, at Surat and Haria in the Surat district and at Chembur in the Bombay Suburban district. Except at Chembur, the demonstrations were very successful in checking hoppers and mildew. It is proposed to continue the demonstrations for another year.

The work on the disease survey of the Province was continued during the year. It is hoped that it may be possible to issue a supplement to the "Fungi of Bombay".

Miscellany.

Necessary facilities were provided to Dr. K. C. Mehta for making stationary slide exposures at different stations in the Province of Bombay in connexion with his studies on the dissemination of wheat rusts in India.

Messrs. S. P. Pingle and M. V. Pandit carried out a survey of places of oversummering of black rust of wheat in this Province and also collected information on the incidence of black rust in relation to meteorological data.

Another consignment of Peerless Dust Guns was imported from America with the help of an advance from the Personal Ledger Account of the Director of Agriculture, Bombay. The machines were sold to *bona fide* growers of this Province at a cost of Rs. 48 each.

Dr. B. N. Uppal continued to work as Secretary-treasurer of the Agricultural Graduates' Employment Board.

Eleven meetings of the Insect Pest and Plant Disease Committee, of which Dr. B. N. Uppal is the Secretary, were held during the year. A large number of insect pests and plant diseases were dealt with at these meetings. The Government have sanctioned the creation of an additional post of clerk on the establishment of the Plant Pathologist to Government for dealing with the work of the Committee.

Publications.

(1) Uppal, B. N., M. K. Patel and J. A. Daji. Nitrogen fixation in rice soils. *Indian Jour. Agric. Sci.* 9, 689–702. 1939.

(2) Kanitkar, U. K. and B. N. Uppal. Twig blight and fruit rot of mango. *Current Sci.* 8, 470–71. 1939.

(3) Uppal, B. N., P. M. Varma and S. P. Capoor. Yellow mosaic of bhendi. *Current Sci.* 9, 227–28.

(4) Uppal, B. N. and S. P. Capoor. The movement of the virus within the host. *Proc. 2nd meeting Crops and Soils Wing Bd. Agr. & Ani. Husb. India.* 1939. (In press.)

B. N. UPPAL,
Plant Pathologist to Government.

Programme of work under the Plant Pathologist to Government for the year 1940–41.

(1) *Fusarium wilt in sann hemp.*—The seed of the resistant strain will be multiplied. The study on the mode of inheritance in sann hemp to wilt will be continued.

(2) *Wilt in Lathyrus sativus.*—The study of the causative organism will be continued. The work on the selection and testing of wilt-resistant strains will also be continued.

(3) *Wilt in Pyrethrum.*—The organism isolated from wilted plants of pyrethrum will be studied.

(4) *Twig blight and fruit rot of mango.*—The work on the histology of the affected plants will be continued. The work on the morphology and systematic position of the fungus will be completed.

(5) *N-fixation in rice fields.*—Laboratory work will be continued.

(6) *Soft rot in ginger.*—Work on the control of the disease by planting disease-free rhizomes on ridges will be done.

(7) *Panama disease of bananas.*—Varietal trials will be continued for another year.

(8) *Koleroga disease of areca-nut.*—The work on the carry-over of the organism will be continued. Trials on the relative value of different "stickers" will be made. The demonstration of method of control of Koleroga by spraying supplemented by destruction of diseased tops of trees will be carried out.

(9) *Damping-off of tobacco seedlings.*—Experiments with Perenox, Mycol and Bordeaux mixture will be done.

(10) *Rust in chryasanthemum.*—Large-scale trials on the control of this rust by spraying with Bordeaux mixture will be carried out.

(11) *Black spot of mango.*—The morphology and physiology of the causative organism will be studied.

(12) *Bacterial leaf-spot of Desmodium.*—The work on the description of the organism will be undertaken.

(13) *Long smut of Andropogon purpurea var. sericeus.*—Work on this (probably) new smut will be done.

(14) *Cotton Wilt Breeding Schemes.*—This work will be continued according to the programme of work approved by the Indian Central Cotton Committee.

(15) *Virus Diseases Scheme.*—This work will be done in accordance with the programme of work approved by the Imperial Council of Agricultural Research.

(16) *Wheat Rust Scheme.*—This work will be done in accordance with the programme of work approved by the Imperial Council of Agricultural Research.

(17) *Disease Survey.*—This work will be continued.

B. N. UPPAL,
Plant Pathologist to Government.

Abstracts of papers published during 1939–40.

(1) Uppal, B. N., M. K. Patel and J. A. Daji. Nitrogen fixation in rice soils. *Indian Jour. Agric. Sci.* 9, 689–702. 1939.

It has been shown that *Azotobacter* plays an important role in the nitrogen recuperation of rice soils at Karjat. The organism is stimulated to greater activity when associated with the growing roots of rice plants, which seem to cause an increase in its efficiency of nitrogen fixation by bringing about a change in the reaction of the medium in the vicinity of living roots.

The organism shows a marked periodicity due probably to external climatic influences in the soil as it is very abundant during the monsoon but suffers a sharp decline in numbers in the dry period following the rains until it becomes scarce and almost disappears from the soil in the cold season and during hot months. This microbial activity during the monsoon is reflected in an increase in the nitrogen-content of the rice soils. The seasonal fluctuations in microbial activity may also have something to do with the growth of the crop since fallow does not support any population of *Azotobacter*-like organisms.

(2) Kanitkar, U. K., and B. N. Uppal. Twig blight and fruit rot of mango. *Current Sci.* 8, 470–71. 1939.

Inoculation experiments with a species of *Phoma*, which is probably new to science, have shown that it can cause twig blight and fruit rot of mango under laboratory conditions. The fungus forms numerous dark brown pycnidia at the margin of the invaded region of the bark. These pycnidia measure from 88 to 248 μ in diameter (56·8 to 145·5 μ in culture) and have an ostiole, which perforates the epidermis. The hyaline pycnospores measures 16·5 to 26·1 by 4·8 to 6·9 μ.

(3) Uppal, B. N., P. M. Varma and S. P. Capoor. Yellow mosaic of bhendi. *Current Sci.* 9, 227–28.

The first visible symptom of bhendi yellow mosaic is the clearing of small veins and then of larger veins. In young leaves these patterns are sharply delineated. The chlorotic areas are at first confined to the veins, but later they extend into the mesophyll and vary in colour from yellowish green to pale yellow. They are not clearly defined, but run out gradually into the normal background of the leaf. There is often a green patch of varying extent in the centre of each area. In badly diseased plants, no marked mosaic but only a general chlorosis develops in the young leaves which may or may not show patches of light green. All growth subsequent to infection is dwarfed, the leaves remain small in size and the petioles are reduced in length. Infected plants blossom sparingly and produce few fruits. In nature plants remain susceptible to infection throughout their life. Under the glasshouse conditions, the diseased leaves show thickening of the veins on the lower side; but no foliar growth or enations are produced on the veins.

The virus of yellow mosaic is not sap-transmissible, nor is the disease transmitted by the seed. The virus is easily transmitted by grafting. The white-fly, *Bemisia gossypiperda*, also transmitted the virus.

Hollyhock is an alternate host of the virus.

(4) Uppal, B. N., and S. P. Capoor. The movement of the virus within the host. *Proc. 2nd meeting Crops and Soils Wing Bd. Agr. and Ani. Husb. India 1939.* (In press.)

This is a review of the literature dealing with the movement of the viruses within the host. The authors have discussed this subject in relation to the path followed by the virus in infected plants and the mechanism and rate of virus movement.

B. N. UPPAL,
Plant Pathologist to Government.

APPENDIX G.

Summary of work done under the Economic Botanist to the Government of Bombay, Poona, for the year 1939–40.

Administration.

Professor L. S. S. Kumar, held charge of the section throughout the year. Mr. V. M. Chavan, Assistant Professor of Botany, was transferred to Karjat as Crop Botanist to Government, with effect from 14th January 1940, vice Mr. M. L. Patel, proceeded on leave. Mr. S. R. Godbole, Assistant Economic Botanist, was promoted to act in place of Mr. Chavan. Mr. S. K. Goni, was appointed the Assistant Economic Botanist, with effect from 10th May 1940 vice Mr. Godbole.

Mr. W. V. Joshi, Mr. S. Solomon and Mr. D. S. Ranga Rao have continued to work as Demonstrator in Botany, Striga Investigator and Oilseeds Breeder respectively.

Teaching.

The Economic Botanist was assisted by the Assistant Professor of Botany and the Demonstrator in Botany in carrying out the teaching work at the Agricultural College, Poona, satisfactorily.

The section arranged a demonstration lecture on seed-testing, method of improvement of grasslands, eradication of weeds and preparing cheap fences from hedge plants for the Officers of Indian Civil Service.

There were five post-graduate students working in this section carrying out research into plant breeding and cytology.

Grass Research.

Grazing Experiment.—The large scale rotational grazing experiment at Mangdara *Kuran* was continued during the year ; but owing to very scanty rain and extremely poor growth of grass the year proved to be the worst of its kind in the history of this experiment. The grazing was commenced on the 16th of October instead of on 16th August as in previous years and it had to be stopped by the end of December 1939, i.e., two months in advance of the time of closure for want of feed.

Data could neither be collected nor observations could be made on the following aspects of the experiment on account of the extremely poor growth of grass namely, (1) grass yield from random quadrats, (2) study of *Andropogon contortus*, and (3) effect of different treatments on *Aristida funiculata*.

Recording the percentage of edible trees and shrubs in the Mangdara Kuran.—Actual counts of plants were taken from four representative quadrats of one acre each. It was found that on an average only

six per cent. of the plants could be utilised as fodder for cattle. This shows that there is considerable scope for planting trees of fodder value by clearing away some of the useless shrubs which at present occupy the area.

The rotational grazing scheme which was commenced in 1931 was closed in December 1939, after carrying out the grazing experiment for eight seasons. Of these eight seasons, only five were good from the point of view of rainfall and consequent growth of grass, one season was moderate and two were extremely bad on account of the prevelance of severe drought. If the data recorded for the moderate and good seasons are considered, the definite advantages of adopting rotational grazing in arid regions where grass lands have been denuded of all vegetation due to excessive and indiscriminate grazing will become apparent. The results of seven seasons under this experiment have been included in the article entitled "*Rotational (Intermittent-intensive) system of Grazing in Bombay Province*" published in "Agriculture and Livestock in India" Vol. IX, Pt. 6, Nov. 1939, pp. 667–675.

Acclamatisation of exotic fodder grasses and legumes.—A collection of 44 grasses and 18 legumes was made from different provinces in India and from countries abroad. These were grown in pots as well as in plots. In many cases germination was satisfactory. Selfed seeds of types that flowered have been collected for further use.

Striga Scheme.

This is the second year of the scheme for Investigation into the attack of *Striga* on *Jowar* which is being financed by the Imperial Council of Agricultural Research from 27th May 1938.

The laboratory test for selecting plants resistant to *Striga* attack has been modified, because it was found that *Striga lutea* seeds germinate better in the dark than in the light. In order to take advantage of this fact the dishes are now placed in dark chambers.

In spite of this modification, which has helped to make the test more reliable, it has been possible to obtain some strains of "Bilichigan" which show 100 per cent. resistance to *Striga lutea*. It is, therefore, of interest to record that 100 per cent. resistant strains have been obtained for the first time. In "Muddinandyal" also a strain showing 96 per cent. resistance has been obtained, which is a definite advance on last year's results. These tests have, however, been carried out under laboratory and not controlled conditions of temperature and moisture.

In the experiment for selecting resistant plants from Central Provinces, Madras and Sind varieties of *jowar*, very disappointing results were obtained. Very few plants showed resistance to *Striga lutea* in the laboratory and the majority of these succumbed to attack when transplanted. However, the seed of some of these plants has been preserved and it is hoped this material will give more promising results next year.

Work has been started in the glass house from January 1940 and a preliminary experiment to study the optimum conditions of temperature and moisture necessary to induce the maximum attack of the parasite has been completed. As a result of this experiment, it was found that a temperature of 35°C and a moisture content of 20 per cent. of the oven-dry weight of the soil used, induced the severest attack of *Striga lutea*.

As a result of experiments done in the field it has been concluded that :—(1) a majority of the selections are resistant to both *S. lutea* and *S. densiflora* under field conditions, (2) the extent of attack of *Striga* is not correlated with the type of *Striga* and *jowar* i.e., whether they come from a *kharif* or *rabi* tract, (3) there is no antagonism between the different species of *Striga*.

Linseed Breeding Scheme.

This report relates to the second year of the extension of the Linseed Breeding Scheme financed from Sir Sassoon David Trust Fund. During the year under report breeding work on linseed was continued at Poona. Yield trial of 18 best selected strains of 1937–38 was carried out by 7 × 7 Latin Square. Analysis of the yield showed that among Nasik varieties, Nanded 1–4–1–1–1 is significantly superior to Nasik Local by 15·6 per cent. at 5 per cent. level of significance ; and Malsiras 1–4–1–1–10 is superior to Local by about 4·7 per cent. but not significantly so. Among Deccan varieties, the trial as a whole was very nearly significant at 5 per cent. level. Sholapur 2–9–1–1–30 was significantly superior to Sholapur Local by 8·5 per cent.; Sholapur 2–9–1–1–36 and Sholapur 2–9–1–2–38 were also superior to the Local by 7·1 per cent. and 5·6 per cent. respectively but the increase in yield was not significant in both the cases. Karnatak strains did not show any significant increase over the Local.

During the year 1939–40 crosses of the previous year were repeated and in addition, a few new and desirable crosses were effected. F_1 progeny of 1938–39 crosses was studied in great detail in each type of cross. Generally speaking, a good many of the crosses exhibited hybrid vigour as manifested by vigorous growth of F_1 plants as against their parents, greater number of branches and capsules and finally greater yield of F_1 compared to their parents. This hybrid vigour was particularly noticeable in the F_1 progeny of Bijapur 1–2–2–1–21 × C.P. white. The general increase in the yield of F_1's as compared to either of their parents varied from 50 to 100 per cent. amongst the different crosses.

Further selection of promising individual plants was continued among the previously selected 18 strains. The yield, oil percentage and iodine value of these individuals are being determined.

As in previous years a few Indian and foreign pure types were maintained and multiplied on a separate plot and their economic characters are being determined.

Oil Seeds Breeding Scheme.

This is the second year of the Oil Seeds Breeding Scheme financed from the Sir Sassoon David Trust Fund.

Sesamum.—Selection of individual plants for high yield and high oil content was carried out. In all 570 individual plants were selected from among 62 different bulk samples and the floral characters and yield of these have been recorded. On the basis of individual plant yield in a type as compared to the average yield of that type and the general mean of all the types, 86 plants were finally retained for the determination of oil percentage. In many types, selected individuals yielded cent per cent. more than the average yield of that type. A few individuals have yielded as high as 140 to 200 grammes per plant, while the general mean of all types is only 30·7 grammes. High-yielding types are generally found to be late in maturing. Among the different types studied, period of maturity varies from 84 to 140 days. Oil percentage of mass-seed of different types varies from 48 to 50 per cent. But all the selected plants have their oil percentage above 50 per cent. and two plants have given an oil percentage of 55. On the basis of yield, oil percentage, period of maturity and the geographical region from which seeds were originally obtained for this trial 25 plants have been selected and these have been grouped having a combination of characters as follows :—(*a*) high-yield, (*b*) high yield and high oil percentage, (*c*) high yield, high oil percentage and early maturity and (*d*) high yield, high oil percentage and late maturity. It is proposed to sow these selections next year according to these groups and record their performance.

Niger.—Selection of plants for high yield and high oil content was carried out. During the year 1939–40, in all 200 individual plants were selected from among 22 bulk samples. Floral characters and yield of these were recorded. A few individuals have yielded as high as 70 to 80 grammes as against the general mean of 30·7 grammes per plant. In regard to oil percentage the general mean of all the types is 36·6 per cent. whereas many selected individuals have yielded oil percentage as much 38 to 40. The period of maturity of different types varies from 90 to 130 days. Many of the Presidency types are early maturing (90–100 days) and yield high. In a few cases high oil percentage is combined with early maturity and high yield. Most of the Mysore types are late types i.e., require 120 to 130 days to mature under Poona conditions.

On the basis of yield, oil percentage and period of maturity, 15 selections have been finally retained for next year's sowing. Grouping of these selections is based on the same lines as in the case of seasamum.

Safflower.—During the year under report 400 individual plant selections were made from among 40 selections of previous year sown during the *rabi* season of 1939. The general mean of all the selections was 79·1 grammes per plant. Many of the selected plants from Gadag, Bailhongal, Bijapur and Vaduj types have given yields as high as 120 to

160 grammes per plant. Period of maturity among different types varies from 126 to 148 days. A few selections from Sangamner, Sinnar and Vaduj types have given good yields coupled with early maturity. On the basis of yield and maturity 123 plants were selected for determining oil content. Oil analysis shows that the mean oil percentage of all types is 29·78 per cent. A large number of the selected individuals show oil percentage varying from 32 to 34·85 per cent. Particularly individuals from Nandurbar, Yeola, Sangamner, Vaduj and Bijapur show high oil content.

A rough yield trial of 20 types in two blocks showed that there were significant difference in the yielding capacities of different varieties. Taking Sholapur variety which yielded lowest in the above yield trial as the standard of comparison, types "Gadag", "Chikodi" and "Yeola" are significantly superior to "Sholapur". Although many other varieties have yielded more than "Sholapur" type, difference between their means and the mean of "Sholapur" are not significant under conditions of the above experiment. More rigid comparisons will be made as the selected types near purity.

Orobanche Research.

Selection of tobacco resistant to *Orobanche* was continued from previously selected plants of Harrison Special, Poona Adcock and G. 6. Only 3 resistant plants from 800 progenies of Harrison Special were obtained. 100 progenies each of Poona Adcock and G. 6. were cultured and they did not yield resistant material. Unlike the work of selection of *jowars* resistant to *Striga*, the attempts to evolve Orobanche-resistant tobacco from the varieties of cigarette tobacco grown in Bombay Province for the past seven years have not yielded any promising results. It would appear that the material under study does not possess any inherent capacity for resistance and selection work has, therefore, proved futile. It is proposed to give up the work of trying to select resistant types from local material. It would now be necessary to obtain seeds of all the different varieties of tobacco and of species allied to *Nicotiana tabaccum* from different parts of the world and carry out a test to find out if any possess the resistant character. Such a type, if available, should be used as a parent in a cross with local tobacco for selecting a type combining the desirable characters of cigarette tobacco with resistance to *Orobanche*. The future work is being organised along this line.

Miscellaneous Experiments.

African versus local bajri.—In the previous year's trial it was observed that if the local *bajri* was sown at the seasonal time (July) and was spaced 18″×4″ apart while the African *bajri* was sown a month in advance of the local and spaced 18″× 12″ apart, the latter out-yielded the former both in respect of grain and fodder, the difference being statistically significant. The experiment was repeated during the year and the result once more confirms that of the previous year. It is proposed to continue the trial to see the effect of spacing both the local and African *bajri* at 18″×12″ apart while retaining the advance sowing of the latter as in previous years.

Electro-culture through use of onionised water.—Experiments with the onionised water on wheat (Bansi 103) and gram (Pusa G-6) were repeated again both in the field and in pots. The field crops were supplied with onionised water once in 10 days and the pot plants twice a week. Both the treated and control plants in pots received 31 waterings while the crop in ground received nine only.

The result of the trial shows that in no case did the treatment prove significantly superior to the control. The treatment on the other hand had a depressing effect on yield of wheat and gram. The experiment shows that there is nothing to the claim that onionised water has beneficial effects on crops.

White-flowered groundnut.—It was sought to be ascertained whether the white-flowered mutant differs in any way in economic characters from the yellow-flowered strains of the local groundnut variety by growing the two types on A B B A plan, replicated eight times. The white-flowered type gave a slightly lower seed and a slightly higher fodder yield but the differences in either case were statistically not significant. The trial will be repeated for another season.

The present local type is defective in that it is a spreading type and it is difficult to harvest the pods. It is, therefore, proposed to utilise the white-flowered mutant as a parent in a cross with Spanish-peanut for obtaining a type which while similar in character to the local should bear the pod in bunches.

The cross to study the inheritance of flower colour and other characters in groundnut will be continued.

Inter-generic cross.—Maintenance of the selected fodder types from *Euchlena* × *Zea* cross was carried out. It is proposed to carry out a comparative trial between the selections and their parents for fodder yield.

Inheritance studies in chillies.—The F_3 generation of the cross between type 60–2 and Superfine Round were studied in detail.

Inheritance studies in castor.—The study of inheritance of characters in crosses between pure lines was continued. Certain new types combining morphological characters of the parents have been selected.

Weed-killing Experiment.—Trials with sodium chlorate in *bajri* plots were repeated and the results of the previous year are confirmed.

Trials with Hedge plants (Cheap fences).—Six different types of hedge plants are planted to study the method of planting, rate of growth, water requirement and cost of planting.

Experiment for destroying trees by poisoning.—A small scale experiment for destroying trees on old buildings and walls, with an application of sodium arsenate was carried out in the village of Wagholi near Poona with success. 23 plants were treated with the solution and all of them died.

Vernalization.—All previous attempts to induce earliness and increased yield by vernalization of wheat and other crop plants had resulted in inducing such slight earliness that the result was of little practical value. Since in previous attempts the period of treatment appeared to be prolonged a fresh trial was made under perfectly controlled conditions by treating for a short period. Wheat was treated for 4 and 8 days at temperature as low as 40°F. The two treatments together with a previously soaked but unvernalized control, were sown in randomised blocks replicated ten times. The characters studied were (*a*) average number of days for flowering from the date of sowing, (*b*) average yield of seed per plant, (*c*) total yield of seed per block, (*d*) total yield of dry fodder per block, (*e*) average number of tillers per plant and (*f*) average height of plants. Results of neither of the treatments significantly differed from controls in any of the aspects studied. From vernalization experiments conducted it would appear that pre-treatment of seed in so far as the late varieties of crops of the Bombay Deccan is concerned has not produced results of any practical importance.

Striga on maize.—An experiment has been taken in hand to evolve maize resistant to *Striga lutea.*

Seed Testing.

Longevity test.—The longevity test on grass and vegetable seeds continues.

Germination under field and laboratory conditions.—Seeds of some of the principal *kharif* and *rabi* crops are being tested for the germination under field and laboratory conditions to establish if possible a formula by which the expected field germination may be estimated from the results of laboratory test. This work will be continued for some years.

Selection of hard and soft seeded types in pulses.—It is proposed to determine whether the character of hardness in seeds of pulses is a genetic character. An experiment has been started to select types by inbreeding for soft and hard characters of seed in *mug* (*Phaseolus radiatus* Linn.) and *udid* (*Phaseolus mungo Linn. var Roxburghii*). This is the first year of the experiment.

176 seed samples received were tested and were reported on. This shows an increase of 59 samples tested over the previous year.

Miscellaneous Work.

Herbarium.—Collection of specimens to replace old ones is being made whenever possible 123 plant specimens were identified during the year. A list of 1,000 medicinal plants from the collection was made and some sheets were given on loan at the time of the 11th All-Karnatak Ayurvedic Conference held at Sirsi in December 1939.

Economic Enquiries.—73 economic enquiries were attended to during the year.

Information on occurance of Pistia.—Information on the occurance of *Pistia* plant supposed to harbour mosquitoes which cause malaria was collected from places all over the province and a statement was prepared and submitted for the use of the Director of Public Health with the Government of Bombay.

Seed supply.—A large collection of seeds of grass and other economic plants were supplied to Portugal, Australia, United States of America and several places in India.

Establishment.

There has been no case of corruption on the part of the subordinates in this section during the year 1939–40.

Publications.

(1) Kumar, L. S. S. .. A note on *Pennisetum typhoideum* Rich. (*Bajri*) affected by *Striga densiflora* Benth. Current Sci., Vol. 8, No. 8, August 1939.

(2) Kumar, L. S. S. and Joshi, W. V. Experiments on the effect of X-ray on *Pennisetum typhoideum* Rich. *Nicotiana tabaccum* Linn. and *Brassica juncea* HK. F and T. The Indian Jour. Agri. Sci., Vol. 9, Pt. 4, August 1939.

(3) Kumar, L. S. S. and Godbole, S. R. Rotational (Intermittent-intensive) system of grazing in Bombay Province. Agri. and Livestock in India, Vol. 9, Pt. 6, November 1939.

(4) Kumar, L. S. S. and Deodikar, G. B. Sex chromosomes in *Coccinia indica* Wright and Arn. Current Sci., Vol. 9, No. 3, March 1940.

(5) Kumar, L. S. S. and Patel, N. M. Natural Cross-fertilization in *Linum usitatissimum* Linn. (Linseed) in the Bombay Deccan. The Jour. of the Univ., Bombay, Vol. 8, Pt. 5, March 1940.

L. S. S. KUMAR,
Economic Botanist to Government,
Bombay.

AGRICULTURAL COLLEGE:
Poona, 19th July 1940.

Abstracts of papers published in 1939-40.

(1) *Kumar, L. S. S.*—A note on *Pennisetum typhoideum* Rich. affected by *Striga densiflora* Benth. *Current Sci.*, Vol. 8, No. 8, August 1939.

The note reports for the first time *bajri* attacked by *Striga densiflora* under field conditions.

(2) *Kumar, L. S. S. and Joshi, W. V.*—Experiments on the Effect of X-ray on *Pennisetum typhoideum* Rich., *Nicotiana tabaccum* Linn. and *Brassica juncea* HK. F and T. *The Indian Jour. Agri. Sci.*, Vol. 9, Pt. 4, August 1939.

The effect of raying ovaries and anthers of *P. typhoideum* with a dose of unfiltered rays produced neither deleterious nor stimulative effect. Germinating seeds of *P. typhoideum* exposed to same dosage as ovaries and anthers produced weak progenies. Mustard and tobacco seeds when rayed showed a general loss in vigour of growth. The weakening was significant in the case of plants raised from irradiated soaked seeds and not significant in the case of those raised from irradiated dry seeds.

(3) *Kumar, L. S. S. and Godbole, S. R.*—Rotational (Intermittent-intensive) system of grazing in Bombay Province. *Agri. and Livestock in India*, Vol. 9, Pt. 6, November 1939.

The article summaries the rotational grazing experiments conducted at Bhamburda and Mangdara Forest *kurans* over a period of twelve years. The advantages of adopting rotational grazing methods to improve grasslands in arid regions where the grass vegetation is denuded by indiscriminate over-grazing is clearly brought out.

(4) *Kumar, L. S: S. and Deodikar, G. B.*—Sex chromosomes of *Coccinea indica* Weight and Arn. *Current Sci.*, Vol. 9, No. 3, March 1940.

The article describes the presence of X and Y chromosomes in *Coccinea indica* and their characteristic behaviour during meiosis. The association of the sex chromosome with the nucleolus and its possible origin from it is discussed. The heterogametic nature of the female and the homogametic nature of the male plant are further supported by statistical analysis of the size variation of pollen grains.

(5) *Kumar, L. S. S. and Patel, N. M.*—Cross-fertilization in *Linum usitatissimum* Linn. (Linseed) in the Bombay Deccan. *The Jour. Univ., Bombay*, Vol. 8, Pt. 5, March 1940.

The paper states that there is an inverse relationship between spacing and extent of natural cross-fertilization in linseed. Closer spacing increases natural crossing. Close pacing produced over 3 per cent. natural crossing and wider spacing reduced it to 0·58 per cent.

L. S. S. KUMAR,
Economic Botanist to Government,
Bombay.

AGRICULTURAL COLLEGE:
Poona, 19th July 1940.

Programme of work under the Economic Botanist to the Government of Bombay, Poona, for the year 1940–41.

(1) *Striga on Jowar.*—Selection of *jowars* resistant to *Striga* will be continued. Effect of *Striga* attack on the physiological functions of the host will be studied. The optimum conditions of temperature and moisture for attack will be determined. The technical programme approved by the Imperial Council of Agricultural Research is being followed.

(2) *Orobanche on tobacco.*—Collection of seeds of tobacco and allied species of *Nicotiana* from the different provinces of India and from countries abroad will be made to select a type resistant to *Orobanche.*

(3) *Linseed Breeding.*—F_1, F_2 and back-cross progenies of crosses in hand will be studied in detail and promising plants will be selected for further observation. Comparative trials between the parents, F_1 and selected progenies of subsequent generations will be carried out.

(4) *Oil Seeds Breeding.*—Selection of superior types of sesamum, niger and safflower for high yield, high oil content and early maturity will be continued.

(5) *Seed testing.*—Work on following items will be continued: (*a*) longevity test of grass and vegetable seeds, (*b*) comparison of the germination of crop seeds under field and laboratory conditions, (*c*) selection of hard and soft seeded types of *mug* and *udid*, (*d*) efficacy of talc in preventing damage by insects in stored seeds.

(6) *Inheritance studies.*—Studies in inheritance of character in groundnut, chilli and castor, linkage studies in cotton, and segregation of types in naturally cross-fertilized cotton will be continued.

(7) *Grass experiment.*—The collection of introduced grasses and legumes will be acclimatized and studies of their growth, flowering and seed setting habits will be carried out.

(8) *Hedge plants.*—The experiment on the suitability of plants as cheap fences will be continued.

(9) *Induction of polyploidy.*—The effect of colchicine in producing polyploidy will be utilised in obtaining newer types in some of the cereals and vegetatively propagated crops.

(10) *Cytology of Papaya.*—Investigations on the cytology of Papaya will be commenced under the scheme sanctioned and financed by the Imperial Council of Agricultural Research.

L. S. S. KUMAR,
Economic Botanist to Government,
Bombay.

AGRICULTURAL COLLEGE:
Poona, 19th July 1940.

APPENDIX H.

SUMMARY OF WORK DONE UNDER THE AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BOMBAY, POONA, FOR THE YEAR 1939-40.

Dr. J. A. Daji held charge of the office and laboratories of the Agricultural Chemist throughout the year. Mr. N. Narayana, Assistant Professor of Chemistry, was on leave for thirty days from 2nd to 31st October 1939. Mr. D. M. Ranade, Senior Assistant, took leave for four months on average pay and for two months and seven days on half average pay from 25th November 1939 and thereafter retired from service from 1st June 1940. In Mr. Ranade, we have lost an accurate analyst. Mr. Ranade's vacancy was temporarily filled in by the transfer of Mr. S. L. Lele from Arbhavi Farm, till the appointment of a permanent incumbent was decided. Mr. V. S. Abhyankar, Lecturer in Chemistry, was on leave for one month from 10th October to 9th November 1939. Mr. M. M. Kibe, Junior Laboratory Assistant, enjoyed earned leave for twenty-three days from 9th to 31st May 1940.

Teaching.—The Assistant Professor and Lecturer carried out the teaching part of the work very satisfactorily. The absence of a Demonstrator is very keenly felt especially as the number of students working in the laboratory at a time has, during the last few years, increased considerably.

There were three post-graduate students working during the year under report. One of them finished his studies and the results of his work are being written up in the form of a thesis for submission to the Bombay University. The other two discontinued their studies.

Analytical and Advisory.—The total number of samples received for analysis this year far exceeded the average received during the last eight years. It was nearly double the number received in previous years. The nature and number of different types of samples received for analysis was as under :—

Type of sample.	Government samples.	Private samples.
Soils	677	3
Waters	54	16
Manures	57	35
Dairy products	7	..
Foods and Feeding-stuffs ..	30	..
Seeds and grains	11	1
Gul and other sugar-products.	1	..
Miscellaneous	394	4
Total ..	1,231	59

The increase is mainly due to the large influx of Government samples. Due to such a large rush of samples the staff was not able to cope up with the work and nearly 320 samples remained unanalysed at the end of the year.

Soils, as usual, formed the largest number. Almost all the soil samples were Government samples and were sent for analysis from different Government Farms in connection with the various experiments carried on at each of those stations. Forty-eight samples were sent by the Professor of Agriculture in connection with a rotation experiment carried on by him at the College Farm. The same officer sent twenty-eight more samples in connection with a green-manuring experiment. The Superintendent, Surat Farm, sent eighty soil samples in connection with green-manuring, rotation and manurial experiments carried on by him at that farm. One hundred and eighty-four samples were received from the Agricultural Meteorologist, Poona, in connection with his study on the seasonal fluctuations in soil nitrogen. The same officer sent forty samples to determine the amount of soluble salts in them. One hundred and thirty-nine samples of soil were analysed in connection with a study on the influence of various crops on the nitrogen changes in the soil carried on jointly with the Plant Pathologist to Government. The Technological Assistant, Dharwar, sent twenty-eight samples in connection with some of his cotton studies. Six samples of soil were analysed for the Economic Botanist with a view to find out their suitability for cinchona cultivation. Seven samples of soil obtained from a *mosambi* garden belonging to a private gentleman were analysed with a view to investigate the nature of a disease prevalent in that garden.

Among the waters received for analysis there were two sent by the Veterinary Investigation Officer, Bombay, which were to be used for preparing sheep dip. Twelve samples of water of Ulhas river were analysed for a private firm that wanted to start some industrial factory. Another twelve samples of river water were analysed to find out the effect of melon cultivation that is usually carried on in winter in river beds.

A sample of manure said to be of foreign origin was found to contain no manurial ingredients at all. Twelve samples of compost prepared from mowhra flowers, sugarcane *pachat*, farm weeds, etc., were analysed for the Professor of Agriculture, Poona. The Superintendent, Arbhavi Farm, sent seven samples of compost prepared by him in different ways. Five samples of various manures were analysed for the Tobacco Breeder, Nadiad.

The dairy products included four samples of ewe milk sent by the Live-stock Expert to Government to study the changes produced in the composition of milk. The Manager, Agricultural College Dairy, sent three samples of *ghee* prepared in different ways.

Two samples of *atta* were analysed for the Chief Marketing Officer, Bombay. One sample of " Granum Flakes " prepared by a Poona firm from whole wheat was analysed for its food value. Six samples consisting of grasses, legumes and leaves were sent by the Live-stock Expert for analysis. The Rice Breeder, Karjat, sent four samples of milled rice of standard strains to determine their food value. Ten samples of castor seed of improved strains and of local selection were analysed for the Tobacco Breeder, Nadiad.

Two hundred and eighty-three samples of various descriptions consisting of cultures, seeds, seedlings, etc. were analysed in connection with a study on nitrogen-fixation carried on jointly with the Plant Pathologist. Twenty-six samples of tobacco were received for analysis from the Tobacco Breeder, Nadiad, to find out the effect of different methods of curing. Three samples of insecticide, two from the Professor of Entomology and one from Plant Pathologist were analysed to find out the nature of insecticidal ingredients present in them. The Horticulturist to Government sent thirty-six samples of *mosambi* fruits to see the effect of different manures on the quality of the fruit. Nine samples of *mosambi* leaves, fruits and roots were analysed in connection with a *mosambi* disease in one of the private gardens.

Research.—The investigation into the intake of nutrients by crops was concluded during the year. The results of this investigation are being written up in the form of a thesis.

The study of the physico-chemical nature of soil types again could not make much progress owing to the pre-occupation of the workers with other work. In this connection, after a number of preliminary trials, two monoliths were obtained of two soil types for further studies. The mechanical analysis of the various horizons of each of the soil profiles collected during the previous year was completed. A few physical constants have been determined.

The investigation into the available nutrients in soils was discontinued as the post-graduate student working on this problem left the College.

A new investigation to find out the cause of a peculiar disease of the *mosambi* trees in some of the private orchards was started during the year. The disease was characterised by a sudden and rapid wilting of the leaves with the leaf margins rolled in. The leaves presented a dark green colour, and were rather smaller in size. This resulted ultimately in the death of the tree, sometimes in the course of a few days. The roots of the affected trees, when dug up, were found to be rotting. No pathogenic organism could be isolated from the affected trees. As the symptoms were more or less indicative of a potash deficiency, the leaves, fruits and roots of affected as well as of healthy trees were analysed for their various constituents. It was found on analysis that the leaves, roots and fruits of affected trees contained less potash than those of apparently healthy trees. The corresponding soils were also found on analysis to be deficient in both total as well as exchangeable potash. A manurial experiment was, therefore, devised to try the effect of fertilisers including potash salts in checking the disease. As no study has been done so far on the nutrition of citrus plants, it was also decided to study the manurial requirements of these trees on different soils in the important citrus growing tracts of the Province. With this object in view, four sites have been selected and manurial experiments laid out. Their progress will be watched with interest.

The study of the fixation of nitrogen by *Azotobacter* was further extended in collaboration with the Plant Pathology section. Raddish, *jowar*, and wheat seedlings, when brought in contact with *Azotobacter*;

were found to increase the activity of the organism, just as the rice seedlings did as reported last year, to fix more nitrogen. When mannite was replaced by molasses or *mowhra* flowers as a source of energy material the organisms made use of these materials as energetically as mannite. The activity, however, decreased, after it reached a maximal, with the increasing quantities of *mowhra* flower or molasses. When the suggestion put forward by some workers that germinating seeds and seedlings fix atmospheric nitrogen without the help of *Azotobacter* was put to test it was found that none of the seedlings tried, viz., rice, wheat, raddish, *jowar* and pea, fixed nitrogen when grown under strictly aseptic conditions.

Investigations into the photo-chemical theory of nitrogen fixation in soils could not be taken up for want of time.

General.—In addition to the samples received for analysis as reported above, nearly one hundred and twenty enquiries were received which were all attended to and advice given wherever necessary. Dr. J. A. Daji worked as a staff editor-treasurer of the Poona Agricultural College Magazine and Mr. N. Narayana as a Rector of the College Hostels.

I am happy to note that no cases of corruption came to my notice during the year.

Publications.—The following papers were published during the year :—

1. The composition of Indian honeys; by J. A. Daji and M. M. Kibe ; Poona Agricultural College Magazine, (1939), *31*, 20-24.

Five samples of genuine honey from Bombay Province and one from Aden were analysed. The average contents of sucrose and reducing sugars were both lower than the limits adopted for genuine honey in America. But the dextrin and mineral matter contents were greater than in the case of the American honeys. No adulterants could be detected in any of the samples.

2. Nitrogen fixation in rice Soils ; by B. N. Uppal, M. K. Patel and J. A. Daji ; Indian Journal Agricultural Science, (1939), *9*, 689-702.

The increase in the nitrogen fixing power of the rice soil in the presence of growing rice seedlings was found to be due to the presence of an *Azotobacter* in the soil. The growing rice seedlings brought about a change in the reaction of the medium which increased the activity of the organisms to fix more nitrogen.

Programme of work for 1940–41.

1. The physico-chemical properties of soil types.
2. Nitrogen fixation by *Azotobacter*.
3. Manurial experiments on *mosambi*.
4. Photo-chemical theory of nitrogen fixation in soils.

J. A. DAJI,

COLLEGE OF AGRICULTURE : Agricultural Chemist to Government of
Poona, July 15, 1940. Bombay, Poona.

APPENDIX I.

Summary of work done under the Crop Botanist to the Government of Bombay, Karjat (Kolaba), for the year 1939–40.

Administration.

Mr. B. S. Kadam continued to be on leave abroad for higher studies, throughout the year under report. Mr. M. L. Patel held the charge as Crop Botanist up to 15th January 1940, and subsequently proceeded on leave for four months; on the expiry of the leave he was transferred to Viramgaon as Cotton Breeder. Mr. V. M. Chavan, Assistant Professor of Botany, Agricultural College, Poona, held charge as Crop Botanist from 16th January 1940 onwards.

Mr. M. V. Gadkari continued as Superintendent of the Rice Breeding Station, Karjat, excepting for the period between 4th September to 3rd October 1939, and between 27th November 1939 to 21st January 1940, when he was on leave. Mr. V. K. Patankar held charge as Superintendent, Cereal Breeding Station, Niphad, throughout the year. Mr. S. M. Patel, Agricultural Overseer, who was in charge of Bajri Breeding work at Niphad, was transferred to Nadiad under the Tobacco Breeder from 13th February 1940, and Mr. R. D. Gaitonde was transferred from Agricultural College, Poona, in his place. Mr. K. A. Patwardhan, Agricultural Overseer, I/C Rice Research Station, Karjat, was transferred to this section from 3rd October 1939; he was on leave for six weeks from 3rd October 1939; and was transferred as Rural Development Inspector, Bassein, from 22nd January 1940. Mr. J. R. Chitnis was taken up in the leave vacancy of Mr. Gadkari from 27th November 1939, and was further continued for work in connection with the Rice Breeding Scheme at Vadgaon (Maval), in Poona District and at present he holds the charge as the Superintendent of the newly opened Rice Breeding Station at Vadgaon.

Rice Breeding.

Selection Material.

(1) *Selection in Zinya.*—The four promising selections were compared for the second time with local and Z 149. No significant difference in yield was found in favour of any of them; 174 fresh selections have been made from the bulk samples collected; these will be now under row trials.

(2) *Selection in Bhadas.*—Ten selections were replicated in a trial for the second time, with local (Mahad) as check; of these 1-B-12-11 is found to be significantly superior to the local and 15-3 is the next promising selection in order of merit. These will be further replicated for the third time. Fifteen new selections have been made for row trials during the coming season, and fresh samples have been collected from all over South Kolaba for further selection work.

(3) *Selection in Kada.*—Six selections from the second lot and one from the first lot were compared with local Kada. 70-2 is a little earlier and 67-1 a little later than local. There is no significant difference in yield, however, 68-1 and 70-5 seem to be rather promising. These six selections will be tried for the third time for final selection. A number of red and white kernelled selections from last year's samples have been made for further purification and trials.

(4) *Selection in Jirbuti.*—One selection from the first lot and four from the second lot were compared with local Jirbuti. 2-J-25-2 and 1-J-86-6, both have yielded less this year. As the performance is not uniform, a further trial for one season will be taken. Selections from Palghar and Badlapur are under the unit selection series and fresh samples have been collected for carrying out further selection work.

(5) *Selection in Mahad.*—Twenty-one selections are chosen for row trials and new local samples are collected for undertaking further selection work.

(6) *Selection in coarse, early and midlate varieties of Konkan.*—As proposed in last year's programme, fresh individual selections have been made in a number of important Konkan varieties, viz. Ghosalwel, Halwar, Patni, Dodki, Patya, Varangal, Tavsal and Dodka.

(7) *Selection in other varieties outside Konkan.*—Selection in Sathi will be under a replicated trial for one year more. A selection from Sutarsal has given significantly higher yield than local for two successive seasons; fifteen new selections from Kaira samples are under row trials. The performance of Bangalya selections is not uniform; they will be, however, tried under replicated tests for one more season. Selections in Wankwel are being further tested; some of these are under row trials. Selections in Kolamba of Palghar (flowering in 85 days), Pankhali and Jiresal will be further tested; those in Dangarbhat, Utavli, Moraya late, Sukhawel and Dhundani are under row trials.

(8) *Selections from scented rices—(a) Long-grained varieties.*—The replicated trial of Kamod and Chimansal with their respective checks was undertaken this year for the first time. Two Kamod selections are slightly superior to Nasik Kamod. Three Chimansal selections were found to be significantly inferior to local Chimansal. This trial will be taken again. The two late Kamod and Raybhog selections were compared with their respective local checks, and it is found that the Kamod selections are significantly superior to Pimpalner Kamod and the Raybhog selections are as good as Raybhog local. Further replicated trials will be taken for selections in each variety. Fresh selections have been made from the scented varieties, viz., Raybhog, Ambemohor, Chimansal, Jirwel and Sakwar; these are transferred to the Rice Breeding Station, Vadgaon, for further selection, together with new local samples of scented rices collected during this year.

(*b*) *Short-grained varieties.*—No. 4 Ambemohor is significantly superior to both local Ambemohor and Jirwel selections, while Jirwel selections 6 and 12 are significantly inferior to local. The trial will be further repeated for verification.

Synthetic material.

(1) *K-226 × B·52 F. 9.*—Out of the eight selections, four have given significantly superior yield to Mahad Bhadas local. The material is promising and the trials will be repeated next year.

(2) *K-42 × K-414 F. 8.*—The two cultures do not show any advantage in yield over K-42. A few selections have been maintained for row trials.

(3) *K-39 × K-164 F. 15, K-501.*—Four cultures were tried with local Ghosalwel and no significant difference in yield was noticed. The strain will be tried under a replicated trial against local Jirbuti and Ghosalwel.

(4-*a*) *P-6 × K-79 F. 9.*—One of the two derivatives, Patni 515-6-19 is significantly superior to the local check, Palghar Dangi, and is earlier by ten days. The two derivatives will be tried along with Kada selections, in a replicated trial.

(4-*b*) *P-6 × K-79 F. 9 (grains like Kolomba), and K-184 × K-79 F. 7.*—Promising selections with less moth attack were compared with K-79, Sutarsal and Jirbuti local in replications; No. 13 is significantly superior to the general mean. It shows more moth attack than K-79, this season. The trial will be continued, without Jirbuti local, which is late.

(5) *K-226 × Sawai Ghosalwel F. 7 and K-226 × Coimbatore F. 5.*—The derivatives were tested along with local Garwel and K-42. The material is being purified. Short-grained selections will be tested in rows with K-226, late ones with local Garwel and long-grained selections from both the crosses with Kalyan Ghosalwel, which is late.

(6) *K-226 × Z-242 F. 5.*—The replicated trial will be repeated after rejecting two short-grained cultures; six are maintained for further trials. 35 promising selections from this cross will be under row trials in comparison with K-226 and Surati Zinya.

(7) *K-226 × Sukhadasi F. 5.*—The material is being selected for obtaining pure types for flowering period and sheath colour; fifteen promising selections are maintained for row trials.

(8) *F. 4 crosses*—(*a*) *Jirbuti × Burma.*—47 promising selections are under study.

(*b*) *K-540 × Z 149.*—Promising selections both midlate and late are under study; the former will be compared with K-540 and the latter with Surati Zinya and Z-149.

(*c*) *Kamod virescent white × K-401 virescent yellow.*—The material is still impure; four selections flowering between 78-83 days are retained for trial with K-79 and K-501.

(*d*) *K-540-56 × K-540 hooked.*—Ten selections flowering with K-79, twelve flowering with K-501 and sixteen flowering between K-540 and K-42 are retained for row trials.

(9) *New Crosses.*—The crosses P–515 × Kada 100–4 and P–515 × M 35 to improve P–515 in its tillering habit and Z–149×K–42 and Z–149× K–414 to improve Z–149 in yield and K–42 in grain size, have been successful, and will be in the F-2 generation during next season.

Agronomic Experiments.

An experiment was started to find the right number of rice seedlings, per bunch, to be transplanted for a late variety. The trial consisted of 4, 6, 8, 10, 12 and 16 seedlings per bunch. The results were not significantly in favour of any of the above treatments. The experiment will be continued.

Yield trials in the District.

No trials were undertaken in the District, this season.

Multiplication and distribution of seed.

Seed of the different improved strains was multiplied on the area of the Rice Research Section which was recently attached to the Rice Breeding Station. The total quantity of seed distributed was 9,840 lbs., out of which 9,710 lbs. was purchased by the Rural Development Department, Bombay, for distribution to the registered seed growers for further multiplication.

BAJRI BREEDING.

(1) The results of the bagging trials are in favour of the improved method of bagging. Different methods of bagging will be again tried next year, to verify the efficacy of the improved system.

(2) From the comparative study of inbred cultures, group-bred cultures, F. 1 crosses, F. 2 crosses (grown from selfed F. 1 seed), back-crosses, out-crosses, and local checks, it is observed that the F. 1 crosses are the best in all economic characters and the out-crosses come next, the group-bred ones are intermediate, but inferior to the local checks, while the others are poor. It seems that in order to produce a marked degree of heterosis, crossing between different types has to be resorted to every year.

Early and late mass selections of 1938–39 were compared with local. The differences in yield were not significant. The late mass has given six per cent. more grain and fourteen per cent. more fodder, valued at Rs. 2-12-0 per acre over the local. The trial will be continued.

(3) *Yield trials of promising bulks.*—One and two years open pollinated bulks of inbred and group-bred strains were tried. Out of the seven strains, none is significantly superior to local. The strain A. F. 3–G 1–G 1 has given eleven per cent. more yield over local. The trial will be repeated along with other competing strains. From the trials of seived versus unseived seed, it is observed that bigger sized seed is advantageous for sowing purposes.

Wheat Breeding.

Synthetic material.

(1) The strain B.G. 8-1 was compared for the fifth time with 808, 168 and local Bansi. The differences in yield are not significant this year. B.G. 8-1 has stood first and 808 last, in yield. The average yields per acre for the last five years are as follows :—

Variety or strain.	Yield per acre in lbs.	Remarks.
B.G. 8-1	773	Stands first in yield; grain of a superior quality.
808	756	
168	718	
Local Bansi	731	

B.G. 8-1 was tried along with local Bansi in the district on cultivators' fields at two places in Yeola and one in Niphad talukas. At all the three places B.G. 8-1 has given higher yields over local varying from five to thirteen per cent. Further district trials of this strain at different places are necessary.

(2) *Baxi 33 × 808.*—Out of the three late derivatives of the cross Baxi 33 × 808 tried under irrigation along with Baxipalli 17-56-63, Pusa 4 and local irrigated Baxi, the derivative 165-6 is found to be better in yield than local as well as Baxi 33, but not significantly superior to them. The three derivatives are found to be significantly superior to Pusa4 as well as Baxipalli 17-56-63 this year. The trial will be continued.

Out of the early derivatives of Baxi 33 × 808, the three sib cultures of 31 family, viz., 31-20, 31-29 and 31-43 promise very good yield. This year the results were not significant, on account of the comparison with 224 which is a late strain. These derivatives will be compared with B.G. 8-1, 808 and local Bansi during the coming season.

(3) *Bansipalli 809 × Pusa 4 F_7.*—Two derivatives were compared with Pusa 4 under irrigation as in previous years. The culture 5-1-3-38-5 is significantly superior to Pusa 4. It possesses full awns, hard shelling and big grain size, characters which are improvements over Pusa 4. The trial will be continued.

(4) *Bansipalli 808 × Polish F_5.*—The derivatives were tried along with 808, but on account of their low tillering habit, they did not stand comparison with 808 in yield. They will be tried under drilled conditions. Further selection in this cross will be continued.

(5) *Trial of Pusa 4, Pusa-165, Baxi-33, and Mondhya.*—These were compared under irrigation as in previous years. Both the Pusa strains have given significantly lower yield than Baxi-33 and Mondhya. Pusa-165 has yielded significantly lower than Pusa 4 again this year; however, it has a better quality of grain; its behaviour against stem rust could not be tested this year.

Black stem rust of wheat.

The Khapli selections, Vernal × Khapli-76, the differential hosts, the segregates of crosses between T. timophevi and T. Vulgare, together with some rust resistant wheats of New South Wales and Leningrad were grown and continued for testing for rust reactions.

Fresh Selections in Local wheats.

Selections from both dry and irrigated important wheat varieties from Deccan and Gujarath were grown in row cultures and compared with their respective local checks for further selection.

Multiplication and Distribution of Seed.

The standard strains, Bansipalli 808, Bansi 168, and Bansi 224 were multiplied in order to maintain the chain of pure seed supply. The new strain B.G. 8-1 was also multiplied for supply of seed for district trials.

The following table gives the quantities of seed of the improved wheat strains, distributed and multiplied by the Station, during 1939-40 :—

Strain.	Seed distributed from 1938-39 crop in lbs.				Seed multiplied 1939-40 crop in lbs.	Remarks.
	Gujarath	N.C.D.	S.C.D.	S. D.		
Bansipalli 808 ..	250	70	..	..	700	From farm.
	130	497	..	90	1,900	„ tenant.
Bansi 168 ..	..	300	..	..	400	
Bansi 224 ..	80	180	..	..	1,000	
B.G. 8-1 ..	..	100	..	..	400	
Total ..	460	1,147	..	90	4,400	

A total quantity of 1,697 lbs. of improved seed was distributed before the sowing season of 1939-40 and the seed multiplied and reserved for distribution from this year's crop amounts to 4,400 lbs.

GRAM BREEDING.

(1) *Yield trials.*—The strains 693, 816 and 822 were compared with Niphad and Khandesh locals. The strain 816 is significantly higher than all the rest. It has been yielding continuously higher for the last three years, giving ten to twenty-four per cent. more yield over local. This strain will be multiplied for distribution and district trials.

(2) During this year Gram 816 was compared on cultivators' fields at Niphad and Shahada. At these places it has given higher yields over local by about ten and eight per cent. respectively; at Niphad the increase in yield is significant. Further district trials are necessary.

Fresh selections.—Selection in local varieties of Khandesh and Nasik is undertaken from this year.

Breeding of Minor Crops.

(1) *Val* (*Dolichos lablab*).—Nine promising selections were compared with local in a latin square; the crop again suffered from virus disease in patches; hence the results are not comparable.

(2) *Rala* (*Sataria italica*).—Rala 4 tried against local by ABBA method by drilling has given about eight per cent. increase over local, but the difference in yield is not significant. The trial will be continued.

(3) *Tur* (*Cajanus indicus*).—T-24 and T-84 were compared with local by drilling. T-84 is found to be significantly superior to local, with about seventeen per cent. increase in yield. Under dibbled conditions also T-84 has given the highest yields. T-24 is not yet quite pure. Fresh selection work in Khandesh and Nasik varieties of Tur is undertaken.

(4) *Til* (*Sesamum indicum*).—Eleven promising selections were compared with local and B-4-9 is found to be significantly superior to the general mean. The culture 8-5-22, 2-10-17 and 7-22-22 are found to be significantly superior to local in yield. The trials will be continued.

(5) *Safflower* (*Carthamus tinctorius*).—Selection work in this crop is in progress since the year 1936-37 on a small scale. Selections from Nagar varieties only are promising. Six Nagar selections were compared with local Niphad. All the selections yielded better than the local, but the differences in yields were not significant. Nagar 47 gave more than twenty per cent. higher yield than the local. The trial will be continued.

Agricultural Meteorological observations.

Precision experiment on rice was conducted again during this year. The results are supplied, as usual, to the Agricultural Meteorologist, Poona. Observations from the small observatory established at Karjat are regularly recorded and reported periodically.

Schemes for Rice Improvements.

Schemes and estimates were prepared and submitted to Government in connection with the establishment of two small rice breeding sub-stations, under the Karjat Rice Breeding Station, at Igatpuri (Nasik District), and at Vadgaon (Poona District) for work on the botanical

improvement of rices, commonly grown in these typical tracts. Out of the two stations proposed, one has been sanctioned and the new Rice Breeding Sub-Station has been started from 1st June 1940, at Vadgaon (Maval) in Poona District, for the improvement of Ambemohor and other local rice varieties of Poona and Satara Districts. The preliminary rice survey of the two districts has been made and samples of important local varieties have been collected for selection. Work in connection with the establishment of the station is in progress.

Another scheme for research work on the improvement of the rice crop and of the rice cultivation on salt lands, Bombay Province, for a period of five years, at an estimated cost of Rs. 40,739 has been prepared by this Section. The Bombay Provincial Agricultural Research Committee has recently approved the scheme and it will be now placed before the Advisory Board of the Imperial Council of Agricultural Research for its approval.

Training in Rice Breeding.

Mr. Rui Da Cruz, B.Sc. (Agri. Hon.), has been admitted at the Rice Breeding Station, Karjat, for training in rice culture and rice breeding work from June 1940.

University Training Corps.

A detailed report on the activities of No. 6 platoon, " B " Company, 1st (Bom.) Bn., U.T.C. (I.T.F.), Poona, for the year 1939-40, was submitted to the Principal, Agricultural College, Poona, by Lt. V. M. Chavan, on 6th July 1940.

V. M. CHAVAN,

Karjat, 22nd July 1940. Crop Botanist to Government,
Bombay Province, Karjat.

Programme of work under the Crop Botanist to Government of Bombay, Karjat (Kolaba), for the year 1940–41.

Rice Breeding.

(1) Replicated yield tests will be carried out between selections from (*a*) Local varieties, (*b*) from varieties outside Konkan and (*c*) the cultures evolved from crosses.

(2) Botanical Selection—

(*a*) Selections made in the local and outside varieties, during last year will be grown in row cultures for further elimination and selection.

(*b*) Fresh selection will be started only in the most important local varieties.

(*c*) Promising cultures from the various crosses will be continued for further selection.

(3) Study of the F 2 population of the crosses made to improve the yield of Z 149 and tillering of P 515 will be made.

(4) Agronomic investigations as to the number of seedlings per bunch will be continued.

(5) Multiplication of pure seed of strains for distribution.

Bajri Breeding.

(1) Further inbreeding, group-breeding and crossing will be continued in the promising cultures.

(2) Study of cultures raised by different methods of breeding will be continued.

(3) Mass selection will be continued and will be compared with local material.

(4) Comparison of one year and two year open-pollinated bulks of promising selections with local material will be made.

(5) Fresh bulk samples from various places of Nasik district will be collected and grown for use in breeding.

Wheat Breeding.

(1) Trial of B. G. 8-1 will be continued with the addition of culture 31 of Baxi 33 × 808 in place of Bansi 168. District trials of this strain will be arranged.

(2) Yield trials of the promising derivatives from Baxi 33 × 808, 809 × Pusa 4 and Polish × 808 will be continued ; selection in these crosses will also be continued.

(3) The trial of I. P. 165 will be continued.

(4) The material for testing against Wheat Stem Rust will be maintained, and further additions will be made to it.

(5) Selection in the important varieties of Deccan and Gujarath will be continued.

Gram Breeding.

(1) Trials of the strain 816 in the district will be continued.

(2) Yield trials of the other promising strains will be continued.

(3) Selection in the Khandesh and Nasik varieties will be continued.

Breeding of Minor Crops.

(1) Rala 4 will be compared with local under drilled condition.

(2) Tur :—

(*a*) The trial of Tur strains, T-24 and T-84 with local by drilling according to the local method will be continued.

(*b*) The trial of other promising Tur selections will be continued.

(3) Trial of the eleven promising strains of Sesamum will be continued.

(4) The trial of promising Nagar selections will be continued.

V. M. CHAVAN,

Karjat, 22nd July 1940. Crop Botanist to Government,
Bombay Province, Karjat.

APPENDIX J.

Summary of Work done under the Agricultural Engineer to Government, Bombay Province, Poona, for the year 1939-40.

Mr. C. G. Paranjpe held charge of the Agricultural Engineering Section of the Department, throughout the year under report. As this is going to be the last report during his regime, it will not be out of place to take a brief review of the work done during the past ten years since he took over charge of the section in 1931. The boring activities were then closed, due to retrenchment, all the boring staff disbanded, and the machines were stored at 3 places for sale. Later permission was obtained to hire them out and the total sale proceeds and the hire realised amount to Rs. 1,01,951 and Rs. 39,195 respectively. The research on implements and machines has resulted in the evolution of, 3 types of automatic seed drills (the all steel, the local converted, and the wheat drill for Jalgaon tract), the wheat thresher, the lime juice extractor, the ball bearing cart wheels, the winnowing fans, the groundnut digger, the soil scooper, the wire ring cutting machine and the hay drying appliance. The renovation of machinery was carried out at several Government Farms such as at Chharodi, Kopergaon, Arbhavi, Dharwar and Bankapur and the Bhadgaon Farm was equipped with a new ginning plant, consisting of the Platt's single roller, single action gin fitted with ball and roller bearings. Amongst the various constructions executed, the cold storage plant, at the Fruit Experiment Station, Kirkee, the installation of machinery at the Sugarcane Research Station, Padegaon, with all the buildings, the water measuring arrangement and other constructions, the various constructions at the Dry Farm Research Station, Bijapur and Sholapur, including the plant house, the water arrangement etc., the several constructions at the Cereal Breeding Station, Niphad, including office, stores, quarters, bore-hole, pumping plant, etc., the houses and runs at the Central Poultry Breeding Station, Kirkee, the constructions at the Sheep Breeding Station, Poona, including the shearing shed, the shearing plant, the paddocks, the bore-holes and the pumping arrangement, the six glass houses, the potting house and two cages at the College of Agriculture, Poona, for the Plant Pathologist to Government, Poona, the steel store house for the Workshop, the students hostels at the Ganeshkhind Fruit Experiment Station and the Poultry Farm, Kirkee, the R. C. C. cattle dip at the Charodi Farm, form some of the important items. The construction of a tube well turbine pump and its installation on the Experimental Well has been also one of the important works executed at the shops.

Turning to the year under report, the construction of the Striga Glass House and the cages at the College of Agriculture, Poona, the glass house at Mahableshwar, the incubator houses, office and poultry runs and houses at the new Poultry Farms at Dharwar and Dhulia, the installation of 2 pumping plants on river Kundalika, the working of the two tractor ploughs in Ahmednagar district, in connection with the Grass Hopper

Scheme and several other works including repairs to boring machines, had kept the staff fully occupied throughout the year.

Advice, help and inspection.

As stated in the last year's report the general activities of the section are steadily increasing. The number of inquiries for advice and help has gone up to 312 against 259 of the previous year. Out of the inquiries received 58 were for pumping, 83 for boring, 3 for tractor ploughing, 1 for cane crusher, 45 for hire of plants, 29 for repairs and 93 for miscellaneous subjects. The number of estimates supplied for machinery and other works amounts to 35. The drawing branch has made out 55 drawings, 36 tracings and 25 sketches for different works. The number of power plants erected amounts to 22 and that for, plants repaired to 58. The sites surveyed amount to 38 and the plants inspected, to 170. Out of the above, the work done by the three Mechanical Assistants is shown in the following statement :—

Headquarter of Mechanical Assistant.	Sites surveyed.	Plants inspected.	Advice given and repairs executed.	Estimates supplied.	Erections made.	Miscellaneous works.
Surat ..	8	96	27	*Nil.*	3	*Nil.*
Poona ..	6	50	6	2	6	*Nil.*
Dharwar ..	14	24	15	3	10	5
Total ..	28	170	48	5	19	5

Research on Implements.

The work done on implements and other appliances is confined to the following :—

(1) Special wheat drill for Jalgaon tract.
(2) Ball bearing cart wheels.
(3) Winnowing fans.
(4) Hay drying appliance.
(5) Experiments with different designs of milk can insertions.

Seed drill.—As stated in the last year's report further experiments in connection with the special wheat drill only were conducted at Jalgaon farm. An experiment was laid down by the Superintendent of the farm to ascertain the difference in yield in the case of local wheat drill and the improved wheat drill with equal seed rate in each case. The results of this experiment are found to be encouraging as the increase in yield in the case of the improved drill is about 10 per cent. More experiments on similar lines are, however, necessary to corroborate the figures obtained this year.

Ball Bearing Cart Wheels.—The problem of boring the wheel bosses for fixing in the ball bearings, without the help of a suitable lathe or a special contrivance, has not yet been properly solved. Attempts are, however, being made to see whether it is possible to get the wheels built on the bosses after fixing the ball bearings and whether the wheels built in this manner, will prove to be as durable as those built in the usual manner. A pair of such wheels recently prepared is being tested and the results of its performance will be given in the next year's report. The demand for these ball bearing wheels is gradually on the increase as 8 such pairs have been supplied to different people during the year under report in addition to 24 pairs supplied before.

Winnowing Fans.—In view of certain difficulties experienced by the District officers in the working of these winnowing fans, it was found advisable to devise some means to change the position of the fan to suit the direction of the natural wind while the fan is being used. A special clamping arrangement has, therefore, to be introduced with the use of which, the fan can be easily raised or lowered or swung in any direction in a short time.

A demand for these fans is gradually on the increase and 7 fans of the double gear type, fitted with ball bearings, have been supplied to different parties during the year under report. The total number of fans so far supplied amounts to 25.

Hay Drying Appliance.—At the request of the Live Stock Expert to Government an appliance for drying tender grass, especially in the monsoons when it is in abundance, has been designed and built for experimental purpose. It consists of an insulated chamber through which hot air from a hearth is blown with the help of a fan. The chamber is provided with a hopper for feeding the tender grass and is fitted with three or four endless metal belts in the inside which are kept in motion during the process of drying, with suitable gearing worked by hand. The grass fed from the hopper falls on the top belt in the chamber from whence it is steadily carried to other belts down below in rotation until it is delivered into the delivery chamber and thus dried on account of its remaining in the hot chamber for a fairly long time. It was observed in the preliminary trials that it is possible to reduce the moisture contents in the tender grass from 70 per cent. to 82 per cent. to 9·29 per cent. in one operation. The capacity of the drying unit per hour in lbs. of tender grass and the cost of drying are yet to be ascertained and this work will be taken up in monsoons next. In view of the results obtained in the preliminary trials it has been decided to build a larger unit for further tests and efforts in that connection are in progress.

Milk Can Insertions.—Experiments with 2 or 3 different designs of milk can insertions are in progress with the object of preventing the formation of cream in the top of the cans, during transit, due to continual shaking and it has been found that the spiral rod insertions are more effective than the disc or wire insertions. A float insertion is under consideration and its results will be given in the next year's report.

Installation of machinery for private individuals, Departmental Institutions; and Public Bodies, etc.

The following is a brief description of the machinery installed by the section for departmental institutions, private individuals and public bodies in all the three divisions of the Province.

GUJARAT DIVISION.

1. Erection of a 5 BHP Peter engine and 3″ × 2½″ centrifugal pump for Mr. G. N. Ghael of Surat.
2. Erection of an 8 BHP Ruston engine and 2½″×2½″ centrifugal pump for Mr. Chhotabhai Khundubhai Desai of Pipaldhara, district Surat.
3. Erection of 7 BHP Bates engine and 3″ × 2″ pump for Mr. Laxman Ramji Patil of Borda, district East Khandesh.

CENTRAL DIVISION.

4. Erection of a 14 BHP Blackstone engine for Mr. Balaram D. Thakor at Varap, district Thana, on river Ulhas. The head is 40′.
5. Erection of a 5″ × 6″ Ruston pump for Mr. Framroj S. Balsara at Girgaon, district Thana, on river Varoli. The head is 60′.
6. Erection of a 10 BHP Peter engine and 4″ × 3″ centrifugal pump for Mr. Vithal Ramji Ukha at Prakash, district East Khandesh, on river Gomati. The head is 55′.
7. Erection of an 11 BHP Blackstone engine and 4″ × 3″ centrifugal pump for Mr. Purandhare at Babardi, district Poona.
8. Erection of an 18 BHP Blackstone engine and 6″ × 5″ centrifugal pump, for a lift of 90′ on the river Bhima for the Ram Maruti Vidyalaya at Vithalnagar, district Poona.
9. Erection of an 11 BHP Blackstone engine and 3″ × 3″ Kirloskar pump for the Patalganga Development Syndicate on Patalganga river.
10. Erection of a 6 BHP engine and 3″ × 3″ pump for the above syndicate on Patalganga river.
11. Erection of a 30 BHP National engine and 6″ × 6″ centrifugal pump on river Varoli for Mr. K. T. Karulkar of Sanjan, district Thana.
12. Erection of a W. & T. Avery, cart weigh-bridge at the Agricultural College Dairy, Poona.
13. Erection of Rahats at Utekhal and Varsai in Kolaba District.
14. Erection of a pumping plant at the Govardhan Dairy, Salisbury Park, Poona.

SOUTHERN DIVISION.

15. Erection of a 6 BHP Peter engine and 2½″ Pulsometer pump for Mr. R. S. Patil of Naginhal on a jack-well near a Nala.

16. Erection of a 9·5 BHP Hindustan engine and 3″ Ruston pump for the Government High School, Bijapur, on a well.

17. Erection of a 2½ BHP Lister engine and 1½″ centrifugal pump on a well for the Laper Assylum, Bijapur.

18. Erection of an 8 BHP Ruston engine and 4″ Kirloskar centrifugal pump on a well for Mr. Patil of Mirgi.

19. Re-erection of the pumping set on the river bank at Arjunwad.

20. Erection of a grinding mill, power chaff-cutter and gin at Dharwar Farm.

21. Erection of a 6 BHP Lister engine for driving chaff-cutter at Bankapur cattle breeding farm.

22. Erection of a 6 BHP Lister engine and 2½″ Kirloskar centrifugal pump for Mr. Halyapnavar of Kalghatgi at Balvantari on a Nala.

Repairs to Machinery.

The following is a short account of the machines repaired by the section.

1. Repairs to Myers pump at Mohol Farm.

2. Repairs to 2 Myers pumps at the Rice Breeding station, Karajat.

3. Repairs to the Myers pump at the Sheep Breeding Farm, Poona.

4. Repairs to pumping plant at the Christ Seva Sangh, Aundh.

5. Repairs to the bore-hole power plant at the Leper Asylum, Kondhva.

6. Repairs to the Pumping Plant at Dhoka and Eranzad on river Ulhas near Badlapur.

7. Laying of pipe line and repairs to the bore-hole pump at Niphad Farm.

8. Repairs to the bore-hole power pump at Kumtha Farm.

9. Overhauling the pumping plant belonging to Mr. Harischandra at Dharwar.

10. Repairs to the Peter engine and chaff-cutter at Bankapur Farm.

11. Repairs to the pumping plant at Indi, district Bijapur.

12. Overhauling the pumping plant at Manoli, district Dharwar.

13. Overhauling the pumping plant at Hulikatti, district Dharwar.

14. Overhauling the pumping engine at Indi Farm.

15. Repairs to the engine at Akkur near Hosratti in Dharwar District.

16. Repairs to the pumping plant of Mr. B. K. Pingale of Talegaon Dhamdhere.

17. Repairs to the pumping plant of Mr. B. L. Dhamdhere of Talegaon Dhamdhere.

18. Repairs to the pumping plant of Mr. S. G. Pingale of Hadapsar.

19. Repairs to the engine at Bhadgaon Farm.

20. Repairs to the engine at Kopergaon Farm.

21. Repairs to the pumping plant of Mr. P. G. Memane of Saswad, district Poona.

Special Works.

The following is a brief description of the special works entrusted to this section during the year under report. With the exception of the Glass House for the wheat rust research, at Mahableshwar, all the works have been completed. The work of the glass house will be resumed immediately after rains and completed by November 1940. This house is very much similar to the " Virus " house at Poona but is slightly smaller. It will not be provided with a 40 mesh phosphor bronze wire gauge at the openings, like Poona, but all the openings will be closed with a fine muslin cloth to prevent the spores from getting inside.

(1) All steel glass house for the Economic Botanist to Government for the " Striga " research work complete with a working table, 2 sinks, a low table for the soil temperature tanks, water connection, an outside gutter, etc., etc :—

Length.	Breadth.	Height to the truss.
28′–0″	15′–4″	10′–0″

(2) A plant house for the above officer consisting of steel frame work 30′–0″ long, 15½′ wide and 12′ high fitted with G. I. square wire netting on all sides and also on the top.

(3) An all steel glass house for wheat rust research at Mahableshwar for the Plant Pathologist to Government complete with adjustable roof ventilators, 4 rooms, porcelain sinks, etc., etc :—

Length.	Breadth.	Height to the truss.
48′–0″	15′–4″	10′–0″

(This house is yet to be completed.)

(4) An elevated steel tank with tower and connections for the above house at Mahableshwar together with fencing the plot with barbed wire and providing 2 steel gates.

(5) Construction of an office 24′ × 14′ × 10′ at Mahableshwar for the above work.

(6) Construction of a plant house or cage for the Plant Pathologist to Government at the Agricultural College, Poona, similar to item 2 above but with different dimensions as under :—

Length.	Breadth.	Height.
50′–0″	20′–0″	10′–0″

(7) Poultry houses and runs for the Live Stock Expert to Government for the new poultry farms at Dhulia and Dharwar, as described below :—

Fixed houses ..	Two at each place of 15′ × 10′ × 6½′.
Portable houses ..	Four at each place of 4′ × 3′ × 4′.
Runs ..	80′ × 80′ × 7′, One at each place.
Chicken yard ..	80′ × 10′ × 10′ One at each place.
Incubator house, Office and brooding house.	One at each place, 35′–3″ × 17′–9″ × 10′.
Manager's quarters.	At Dhulia only 23′–3″ × 24′ × 10′.

(8) Glass room at Arbhavi Farm, in the office verandah near the laboratory 13′ × 6′ × 6½′.

(9) R. C. C. Storage tank 6′ × 4′ × 4′ for the Sheep Breeding Station, Poona, to hold 600 gallons.

(10) Construction of an office 15′ × 10′ × 10′ for the Cold Storage Plant at Ganeshkhind Fruit Experiment Station, Kirkee.

Works done at the shops.

A brief summary of the work done at the shops for departmental and other institutions and private individuals during the year under report is given as under :—

1. Making steel racks for the office of the Director of Agriculture, Bombay Province, Poona.
2. Repairs to the sluice valves of the Rice Breeding station, Karajat.
3. Repairs to big end brasses of the engine at Jalgaon Farm.
4. Repairs to the Myers Pump of Arbhavi Farm.
5. Repairs to the Leaf punch and the petrol tank of the Gas Plant of the Sugarcane Research Scheme, Padegaon.
6. Testing Vacuum and Gas containers and making necessary brass fittings for same and testing them for the Cold Storage Plant, Kirkee.
7. Making needle valves seats for the Compressor of the Cold Storage Plant, Kirkee.

8. Renewal of condenser tubes and testing them for the above plant.

9. Repairs to the pressure gauge of the air container of the Blackstone engine at Ganeshkhind Fruit Experiment Station.

10. Repairs to Dumpy Level and its stand of the Professor of Agricultural Engineering, Physics and Mathematics, Poona.

11. Repairs to and alteration in the Reaper, Binder and Cotton Planter of the above Officer.

12. Repairs to the sectional models of the above officer.

13. Repairs to the iron mhote at Modi Bagh.

14. Making curtains and fixing same to the " Virus " glass house for the Plant Pathologist to Government, Bombay Province, Poona.

15. Making a switch board box and pipe pole for the electric wire connections for the " Virus " house of the above officer.

16. Repairs to the hot air engine for the Agricultural Chemist to Government, Bombay Province, Poona.

17. Repairs to the cane crusher of the Agricultural College, Poona.

18. Testing of the Jet flame throwers purchased for the Grasshopper Scheme.

19. Occasional repairs to the tractor and ploughs loaned to the Divisional Superintendent of Agriculture, Belapur, for the Grasshopper Scheme.

20. Repairs to —

7 famine sets,
19 hand boring machines,
2 Calyx drills, and
1 Musto power boring machine.

21. Manufacture of the Grass Drying Appliance.

22. Manufacture of the Milk can alluminium insertions.

23. General repairs to Workshop and Experimental Well machinery.

24. Manufacture of 7 Winnowing fans of the latest type.

25. Works in connection with the construction of the Glass houses at Poona and Mahableshwar, including fencing, elevated tank and tower, etc. etc.

26. Construction of two cages, one for the Plant Pathologist to Government and the other for the Economic Botanist to Government, Poona.

27. Manufacture of poultry houses for the new poultry farms at Dharwar and Dhulia.

Machines hired out.

Boring Machines.—The number of boring machines supplied on hire amounts to 7 and from the information received from the parties concerned, they have sunk 22 bores, bored an aggregate depth of 4,849 feet and tapped 19,110 gallons of water per hour. The total hire realised amounts to Rs. 7,193-0-10.

Pumps.—The number of pumps, both hand and power driven supplied to different people on hire, amounts to 11 only and the hire realised comes to Rs. 367-9-7.

General.

There has been a considerable change in the staff owing to the transfer of the Head Clerk, Mr. Limaye to the Sugarcane Research Station, Padegaon, and the second clerk Mr. Deshmukha to the office of the Director of Agriculture, Bombay Province, Poona. Mr. Limaye's place has been taken by Mr. Pandya, our permanent Storekeeper, who has been succeeded by Mr. Joshi, the third clerk. The section has lost in these two people, two able and experienced hands. The Shop Superintendent Mr. Chitale was on leave for two months and a half.

The total receipts, on hire of boring machines and pumping plants, on the sale of boring machines and other stores and on the services rendered during the year amount to Rs. 13,546-9-8, as detailed below :—

Rs.	a.	p.	
367	9	7	Hire of pumping plants.
7,193	0	10	Hire of boring machines.
760	15	6	Hire of sundry tools.
414	0	0	Sale of boring tools and spares.
3,801	1	10	Sale of boring machines.
260	14	3	Sale of sundry stores.
15	0	0	Fees of Oil Engine Class from students in State jurisdiction.
293	15	8	Charges for mechanical assistance.
440	0	0	Hire of tractor.
13,546	9	8	

In addition to the above the cost of services rendered and the work executed at the shops, for departmental institutions, for which the bills are simply accepted, amounts to Rs. 370-0-4.

The number of students trained in the Oil Engine Class amounts to 11 only as the class was not open between April to July 1940 on account of inadequate number of students.

The staff in general, including the 3 mechanical assistants, has done exceedingly well. A special mention is, however, necessary for the very valuable services rendered by fitter Mr. Khadilkar, in the construction of the Glass Houses and by Mr. Chitale, the shop superintendent in the efficient management of the shops.

The DeSegundo Defibrating machine, stored at the Surat Farm was sold to Messrs. The New Laxmi Oil and Chemical Works Ltd., Bombay, for a sum of Rs. 1,100 and the sale proceeds have been sent to the Indian Central Cotton Committee, Bombay, direct by the party concerned.

C. G. PARANJPE,
Agricultural Engineer to Government,
Bombay Province, Poona.

Programme of work under the Agricultural Engineer to Government, Bombay Province, Poona, for the year 1940-41.

1. Research on implements including their modifications and tests.	(*a*)	Modifications and tests with wheat drill, groundnut digger, soil scooper, ball bearing cart wheels, tyne cultivator, ridging implement, clod crusher and milk can insertions, etc.
	(*b*)	Trial with the Grass Drying Appliance.
	(*c*)	Study of indigenous implements and design of new implements.
2. Famine Pumping ..	(*a*)	Inspection of Pumping Sites on big rivers in the Province for growing fodder.
	(*b*)	Keeping the 7 famine pumping sets in readiness.
3. Advice and help ..	(*a*)	Training of cultivator students in driving of engines and pumps.
	(*b*)	Periodical inspection of Agricultural machinery.
	(*c*)	Advice to Divisional Officers in machinery matters.
	(*d*)	Advice to cultivators in agricultural machinery and periodical inspection of their power plants.
	(*e*)	Survey of sites and supply of drawings and estimates.
	(*f*)	Erection and repairs of machinery for private individuals through the Mechanical Assistants.
4. Higher Technical Assistance.	(*a*)	Help to the Divisional and other Departmental officers in case of repairs and break downs.
	(*b*)	Erection of water lifts or new machines belonging to the Department.
5. Special works ..	(*a*)	Completion of the Glass house at Mahableshwar together with sanitary and water supply arrangements and boring.
	(*b*)	Construction of an Insectary for the Professor of Entomology.

		(*c*) Construction of additional Insectary for the Plant Pathologist to Government, Poona.
		(*d*) Construction of a Glass House at Sirsi for the Plant Pathologist to Government, for research on Cardamom disease.
		(*e*) Construction of a new byre at Tegur Farm with fencing and repairs to old quarters, byres and the cattle dip.
		(*f*) Construction of a Tobacco curing barn and damping room for the Tobacco Breeder, Nipani.
6. Running of Plants	..	(*a*) Running of the workshops and demonstration of water lifts on the experimental well.
7. Sale and hire of machines.		(*a*) Repairs to boring machines, their sale and hire.
		(*b*) Hire of pumping plants and other machines and sale of stores and tools.
8. General ..	..	(*a*) Routine work pertaining to office, workshops and divisions.
		(*b*) Charge and maintenance of the following :—
		The Nangaon Pumping Plant. The Boring machines at 3 depôts.
		The power baling and bruising plant at Karajgi. The steam plough.
		(*c*) Closing the depôt at Nadiad on removal of the stock, machines and tools and plant to Poona or elsewhere.

C. G. PARANJPE,
Agricultural Engineer to Government,
Bombay Province, Poona.

APPENDIX K.

Summary of work done under the Horticulturist to Government, Bombay Province, Poona, for the year 1939–40.

I. Administration.

The services of Mr. P. G. Dani, Assistant Horticulturist were transferred to the Rural Development Department from 1st August 1939. Mr. S. R. Gandhi who was on deputation to the Ceylon Government returned to the Bombay Agricultural Department and was posted as Superintendent, Ganeshkhind Fruit Experiment Station, Kirkee, from 16th May 1940. Consequently, Mr. B. Nazareth, reverted as Superintendent, Modibag and Mr. R. S. Dubhashi as Agricultural Overseer under Horticulturist to Government, from the same date.

As required by Government Resolution, Memorandum No. 8490/33, Revenue Department of 7th July 1938, it is reported that there was no case of the nature mentioned in the Government Resolution in this section.

II. Education.

The performance of B.Sc. (Agri.) students in Horticulture in the last University Examination was quite satisfactory. Out of 38 students, 33 passed with Honours and 4 secured pass marks only. Four students attended a Special Course in fruit preservation. There were 80 students in the Horticultural Training Class at the Ganeshkhind Fruit Experiment Station, Kirkee. Seven out of these failed to secure the requisite number of marks required for passing at the test examination held in March 1940. The students evinced keen interest in all the orchard and nursery work. The class was very popular.

III. Laboratory and Cold Storage Research.

1. *Laboratory.*—Observations on the drying of Karwanda showed that it takes 26 days for complete drying in shade instead of 15 days for sun-drying. The product dried in shade has a disagreeable flavour. The percentage of shade dried product compares favourably with that of the sun dried being 27·3 per cent.

In regard to the tapping of chiku trees for chicle, four trees were regularly tapped in July, September and November. It was observed that when trees are tapped by making a slant cut into the bark in the morning before sunrise, it was possible to collect some latex. The total yield of latex from four trees during the season amounted to 8 ozs. only. This work is dropped out of the programme.

2. *Cold Storage.*—It was found that the rate of ripening the Alphonso mango decreased considerably when it was kept under partial

vacuum at 68°F. In ripe fruit that was kept under partial vacuum at 52°F. the browning of the pulp near the stone was prevented and the fruit remained in good condition for about a month.

The storage temperatures of 52° and 40°F. had no effect on the vitamin C contents of Nagpur oranges for three months. Nagpur oranges stored at 40°F. for three months and then sent to Nagpur by railway appeared to stand the journey well but the juice gave a slightly fermenting odour. This showed the necessity of refrigerated railway transport for this fruit.

Rajeli banana from Bassein got chilled at 52°F. but they ripened at 56°F. after two or three weeks. The bananas when ripe did not keep for more than four days as brown specks appeared on the yellow skin and the fingers became detached from the main stalk. Bananas stored as "hands" and "singles" showed fungal growth at the cut portion which became wilted. The application of a mixture of melted paraffin wax and vaseline to the stalks of "singles" proved to be a satisfactory control of fungal growth and wilting.

Pears from Kashmir tested this year remained in good condition for four months at 32°F. This lot of fruit was less mature than the fruit tested last year.

Ripe figs could be kept in a sound condition for about a month at 32° and 35°F. Papaya got chilled at 68°F. and lower temperatures. Limes remained in good condition for two months at 52°F. when kept in a closed tin. Green tomatoes ripened at 52°F. and developed a good colour within a month.

IV. Work at the Ganeshkhind Fruit Experiment Station, Kirkee.

(*a*) *Manuring of Basrai Bananas.*—The manurial treatments for the third year showed that the treatment of castor cake 10 lbs. and sulphate of Potash 2 lbs. given in three equal doses with 80 lbs. Farm Yard Manure as basic dose gave 30 per cent. better results in respect of yield and 35 per cent. in weight of bunches. The experiment has given significant results.

(*b*) *Manuring of grapes.*—The combined dose of Niciphos, bonemeal and Sulphate of Potash yielded 19 per cent. more than Farm Yard Manure treatment. The experiment has not yet given significant results.

(*c*) *Manuring of Mango.*—The vegetative performance of plants treated with Farm Yard Manure plus Ammonium Sulphate and Farm Yard Manure plus Bonemeal is promising. Observations in regard to vegetative growth are being recorded and analysed.

(*d*) *Manuring of Mosambi.*—The manurial treatments have not given any significant results so far but the Farm Yard Manure plus Castor Cake treatment has given slightly more yield than the control.

(*e*) *Irrigation methods*—(1) *Mosambi.*—The bed and the furrow methods of irrigation are being compared. It was found that the furrow method took 29 per cent. more water than the bed method but gave less yield.

(2) *Grape vines.*—The furrow system showed 22 per cent. increased consumption of water but no increase in yield.

(*f*) *Improvement of guavas by selection.*—Lucknow No. 49 which has been found to be the best selection fetches more income than any other variety.

(*g*) *Improvement of pomegranate by selection.*—G.B. No. 1 is the best selection. Promising selections from Dholka have been made and will be studied in detail in future.

(*h*) *Alternate bearing of mangoes.*—Some 600 shoots were labelled for observation. About 93 per cent. of the shoots marked blossomed in 1937-38. Out of these 600 shoots only 34 shoot, i.e., 5 per cent. of the labelled ones have fruited this year. Some vigorous shoots were found to produce flower shoots early in the season and later put forth vegetative growth. Further observations are being recorded.

Trial of Bread Anama a.—The seed of Bread Anamama (Solanum nigrum) received by the Director of Agriculture, from Dr. D. J. Hnyessen Kurseong of Darjeeling was given a trial on a plot scale. Solanum nigrum appears to grow properly and bears heavily. The foliage has been tried as a vegetable but it is not much relished here. From the fruit, however, good jam can be prepared.

Trial of American Beans.—A trial was given to American beans also. This bean grows very well and is productive. It makes a good vegetable. It is now growing and bearing for the second year.

The total receipts of the garden amounted to Rs. 13,257 the expenditure under cultivation being Rs. 11,803.

V. Work at Modibag.

Facilities for the teaching of College students were provided for as usual. Facilities were also provided to the Assistant Horticulturist of the Rural Development Department for his class work. Besides parties of students from the Seva Sadan Society, Poona, Seva Sadan Training College of Women, Poona Training College, Hingne, Basic Training School, Loni Kalbhor, the Dhulia Agricultural School and the Bijapur High School visited the garden for instructions in Horticulture.

The receipts of the garden for the year amounted to Rs. 4,764 the expenditure under contingencies being the same as before, namely, Rs. 4,340. A total saving of Rs. 160 was made out of this contingent grant for the purchase of some essential articles. The monsoon of the

year being unfavourable, a good number of mango grafts and banana suckers remained unsold thus telling upon the income of the garden to a certain extent.

The old unremunerative grape vine plantation and pomegranate plants were cut down and planted with Mosambi and Mango varieties respectively. These plots may yield some income in course of time. Intercrops of Cabbage, Knolkol, Cauliflower and tomatoes were successfully grown.

An experiment was laid out to find out (1) the spacing requirements of Jamburi seedlings, (2) the effects of pruning *vs.* non-pruning of roots at transplanting, (3) propagation of Jamburi by cuttings *vs.* seedlings and (4) growing Jamburi on ridges *vs.* beds. Some preliminary data were recorded.

An attempt was successfully made to collect cauliflower seed which will be tested for germination percentage.

The Fruit and Vegetable Committee visited the garden on 4th May 1940 and inspected the above work as also the root exposure work carried out without additional expenditure. The root exposure work showed that (*a*) round cuts gave profuse rootlets, (*b*) rootlets formed the best at 3 feet distance from the main stem, (*c*) rootlets formed better on Jamburi stock.

VI. Miscellaneous Work.

The National Planning Committee invited Dr. G. S. Cheema to work as a Chairman and Mr. R. S. Dubhashi as a member of their Horticultural Sub-Committee. The Director of Agriculture allowed these Officers to work in the respective capacities at their own cost. The final report was submitted to the National Planning Committee in March 1940.

VII. Publications.

Cheema G. S. .. The Future of Horticultural Industry in India, Indian Market, Vol. 5, No. 1, October 1939.

Sayed I. A. .. Manurial Programme for the garden. The Gardener, Vol. III, No. 2, 1939.

Sayed I. A. .. Canning of Pineapple in the Province of Bombay, Poona Agricultural College Magazine, Vol. 31, No. 3, 1939.

VIII. Programme of Work for 1940-41.

1. Manurial experiments :—
   (*a*) Benana.
   (*b*) Mosambi.
   (*c*) Grapes.
   (*d*) Mango.
2. Manurial trials to determine the economies of manures—(Basrai banana).
3. Selection of Pomegranates.
4. Alternate bearing of mangoes.
5. Opening of a basic nursery.
6. Root exposure studies.
7. Training of agriculturists in Horticulture.
8. Survey of fruit areas in the Province.
9. Cold Storage and Gas Storage research.

G. S. CHEEMA,
Horticulturist to Government,
Bombay Province, Poona.

College of Agriculture,
Poona, July 1940.

Abstract of Publications.

1. *The Future of Horticultural Industry in India.*—The importance of fruit as a necessary item in the diet is emphasised and hence the need for growing more fruit. It is observed that the fruit grower does not get his dues owing to defects in the system of marketing. It is, however, felt that as a result of development of markets in large towns, transport facilities, etc., both production and consumption of fruit are steadily increasing. The author has given import figure which clarify the scope of fruit industry in India.

2. *Manurial Programme for the Garden.*—The author has suggested a manurial programme for each of the garden subjects such as annuals, shrubs, creepers, bulbs, roses, palms, ferns and begonias, window boxes, and hanging baskets and lawns.

3. *Canning of pineapple in the Province of Bombay.*—The importance of pineapple as a rich source of vitamins and a commodity of export has been emphasised. Cultivation of pineapple in this Province is negligible although areas having suitable soil and climate are available. There is great demand for fresh and canned pineapple and large quantities of canned pineapple are annually imported into this Province. The author has described in detail the process of canning pineapple.

APPENDIX L.

Summary of work done by the Professor of Agricultural Economics, College of Agriculture, Poona, and Provincial Marketing Officer, Bombay Province, Poona, for the Year 1939–40.

Dr. M. B. Ghatge continued as Professor of Agricultural Economics throughout the year but he relinquished his charge of Provincial Marketing Officer on 24th October 1939. Consequently Messrs. N. V. Bhagwat, B. H. Patil, B. P. Deshpande and A. K. B. Cazi, the Assistant Marketing Officers with their establishment were transferred to Bombay to work under Dr. T. G. Shirname, the Chief Marketing Officer, Bombay. Mr. K. S. Patel, Investigator in Agricultural Economics, was appointed as Demonstrator in Agricultural Economics in place of Dr. K. M. Shah transferred as Rural Development Inspector. Mr. L. H. Mirajkar was appointed as Investigator in Agricultural Economics in place of Mr. K. S. Patel from September 1939.

Education.

During the year for the B.Sc. (Agri.) examination of the University 42 students appeared in agricultural economics—the subject taught by this section—out of which only two students failed. The result thus in this subject was 95·2 per cent.

As in the previous year on one morning the topics pertaining to the economics of agriculture and agriculture were discussed with the Civilians who attended the course at this college in the month of September.

Research.

The one year study of farm family budgets of 48 farmers undertaken after the completion of the "Farm Costing" study in the Charotar tract was wound up in May 1939. Thereafter the staff was busy collating the data of the farm costing work and in preparing a final report for publication in the form of a bulletin. It is now ready for submission to the Director of Agriculture, Bombay Province, Poona.

Side by side collation of the data on family budget study was in progress. It pointed out that the total expenditure amounted to Rs. 353-10-8 for *patidars* and Rs. 263-8-1 for non-*patidars*, the average of the tract being Rs. 317-6-6. The percentage distribution of the expenditure on different heads given in the table below shows that food absorbs a very large proportion. It must be borne in mind that though the percentages per head for *patidars* and non-*patidars* vary within a very small range of about 2 per cent. of the total, the amount available for expe is less by about Rs. 20 for non-*patidars*.

TABLE No. 1 :—*Expenditure on different accounts for patidars and non-patidars.*

Heads of expenditure.	Patidars.		Non-patidars.		All.	
	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.
	Rs. a. p.		Rs. a. p.		Rs. a. p.	
1. Food	209 4 4	59·2	161 4 8	61·2	190 4 4	60·0
2. Clothes and cleanliness ..	34 13 4	9·9	22 10 2	8·6	30 0 1	9·4
3. Rents and repairs ..	5 8 5	1·5	9 8 10	3·7	7 1 11	2·2
4. Light and fuel ..	14 9 9	4·1	12 9 9	4·8	13 4 2	4·2
5. Medicine	6 1 2	1·7	1 10 0	0·6	4 5 0	1·4
6. Education	7 11 10	2·2	0 2 11	0·1	4 12 0	1·5
7. Amusement and luxury ..	10 6 10	3·0	10 2 1	3·8	10 4 11	3·2
8. Marriage, death, religion, etc.	52 8 9	14·8	35 5 7	13·4	45 11 9	14·4
9. Legal protection ..	3 1 1	0·9	1 8 3	0·6	2 7 2	0·8
10. Purchase of household utensils, ornaments, etc.	9 9 2	2·7	8 9 10	3·2	9 3 2	2·9
Total ..	353 10 8	100·0	263 8 1	100·0	317 6 6	100·0
Per head ..	68 6 10	..	48 9 10	..	60 3 8	..

This too will be ready for submission to the Director of Agriculture, Bombay Province, Poona, soon.

In addition to the above activities some of the important miscellaneous items of work consisted of the following :—

(1) The report on the cost accounting work conducted at Malsiras and submitted in the previous year was further concised as desired by the Director of Agriculture, Bombay Province, Poona, for purposes of publication.

(2) Complete information in respect of land, cropping, holdings, fragments of land, etc., was collected of the village Lonikand, 13 miles from Poona on the Poona-Ahmednagar road with a view to selecting 10 farmers for studying the aggregate effect of all improvements suggested by the Department of Agriculture. The detailed scheme was submitted to the Director of Agriculture, Bombay Province, Poona.

(3) The questionnaire prepared by the National Planning Committee was replied. For the same Committee figures of production, import, export and net available supplies for those commodities for which published data was available were compiled and consolidated.

(4) The required statistical information was collected for replying the questionnaire of the Land Revenue Commission of Bengal and querries in connection with the price of rice and to maintain it at reasonable level by means of regulating the imports of rice and grain compensation allowance to Government low paid servants.

Survey of Marketing and its Development.

Surveys.—Surveys on sugar and *gul*, sheep and goat, fish and lac, mangoes, apples, pineapples and cashewnuts were continued. The marketing of vegetables produced in the vicinity of Poona City was studied and the possibilities of organising the wholesale and retail disposal of these vegetables on co-operative lines were explored as desired by the Honourable Minister. A report in that connection was submitted to the Director of Agriculture, Bombay Province, Poona.

The primary reports on sugar and *gul*, sheep and goat, mangoes and cashewnuts had approached completion. A part of the information of sugar and *gul* was in fact submitted to the Agricultural Marketing Adviser.

Supplementary information on rice, groundnut, cocoanut, markets and fairs, potato, milk, ghee and butter and fibres occupied a good deal of time of the marketing staff.

Development.—It consisted mainly of (A) fixing of grade specifications, (B) Authorisation, (C) Enforcement of standard contracts, (D) Popularising grades and grading, (E) Inspection, (F) Holding conferences and meetings, (G) Demonstrations, etc.

(A) *Grade specification.*—(*a*) a large number of samples of Zinia rice from Panvel, Kalyan-Bhivandi and Surat were collected and analysed and tentative standards were evolved.

(*b*) Preliminary arrangements for starting an experimental groundnut grading station at Kolhapur were made by holding meetings of merchants and the issue of leaflets.

(*c*) Information about mango products was collected with a view to defining grades for them.

(*d*) Arrangements were made to define grades of alphonso mangoes (for home consumption).

(B) *Authorisation.*—During the period under report 5 persons were authorised to grade eggs under the Agricultural Produce (Grading and Marking) Act of 1937 in addition to the previous persons authorised.

(C) *Standard contracts.*—The Marwari Chamber of Commerce delivered 121,500 maunds of linseed under All-India New Standard Contract.

(D) *Grades and Grading Stations.*—The grading of hides, eggs, ghee, *mosambi* and mango continued. Nearly 2½ lacs of *mosambis* and 125,000 mangoes, 50,000 at Bulsār and 75,000 at Ratnagiri were graded. Efforts were made to create demand for AGMARK products by articles in papers, by cyclo-styled notes and even by personal approaches.

(E) *Inspection.*—Grading stations in hides, eggs, *mosambis*, ghee, and mangoes were often inspected. For eggs a candler was appointed in Bombay for 6 months from July 1939. More than a dozen samples of ghee tins were collected from time to time for supply to the Central Ghee Control Laboratory, Cawnpore, as check samples. Weekly returns of quantities graded, and of the number of labels used were submitted to the Agricultural Marketing Adviser.

(F) *Market intelligence.*—Publication of weekly bulletins regarding milk and milch cattle in Bombay was continued. Besides arrangements for telegraphic information between Bombay and Delhi and Bombay and Mehasana were continued.

(G) *Conferences and meetings.*—A conference of the Vanaspati Manufacturers in India was held in Bombay under the Chairmanship of the Vice-chairman of the Imperial Council of Agricultural Research on 28th July 1939 which the Provincial Marketing Officer and the Assistant Marketing Officer in charge attended. Rules of grading and marking *vanaspati* and grade specifications were discussed and fixed at this conference. A number of meetings were organised of tanners, butchers at Bandra for grading hides, of mango merchants in Ratnagiri for grading mangoes, and of groundnut merchants at Kolhapur. The Provincial Marketing Officer attended the meetings convened by the Livestock Expert to the Government of Bombay in connection with the question of stopping adulteration of ghee.

(H) *Demonstration.*—Arranged a small show in the office of the Provincial Marketing Officer for demonstrating the activities of the marketing as well as of the Economics Section to the local leaders of Poona.

In addition some of the miscellaneous items of work consisted of preparing cases for securing railway facilities to consignors of fruits and vegetables, arranging help to consignors of graded mangoes from Chittoor, eggs from Peshawar, supplying samples of potatoes to the Agricultural Marketing Adviser, Delhi, and attended to the enquiries from the public.

Corruption.

Proper supervision was maintained to see that there was no corruption in this section and that there was no case of corruption to report during the year under report.

Notes, papers and articles contributed.

	Title.	Contributed to.
1.	Dairying as subsidiary industry to agriculturists in the Charotar tract of Gujarat by Dr. M. B. Ghatge and Mr. K. S. Patel.	Agriculture and Live-stock in India, Vol. IX, part IV, July 1939.
2.	A review of work on agricultural economics in India and consideration of the application of the results obtained from such investigation by Dr. M. B. Ghatge.	A paper submitted to the Crops and Soil Wing of the Board of Agriculture and Animal Husbandry in India.
3.	The task that lies before an Agricultural Economist in India by Dr. M. B. Ghatge.	Papers submitted to the First Conference of the Indian Society of Agricultural Economists.
4.	A few facts about agricultural land in the Deccan of Bombay Province by Dr. M. B. Ghatge and L. H. Mirajkar.	
5.	A few facts about farm labour in the Charotar of Kaira District, Bombay, by Dr. M. B. Ghatge and Mr. K. S. Patel.	
6.	Mixed farming is the possible way to success in peasant farming by Dr. M. B. Ghatge.	An article submitted to Editor, the "Indian Farming".
7.	Should Provincial Self-sufficiency be the aim in National Planning ?	A note submitted to the National Planning Committee, Bombay.

College of Agriculture,
Poona, 13th July 1940.

M. B. GHATGE,
Professor of Agricultural Economics.

Programme of work under the Professor of Agricultural Economics, College of Agriculture, Poona, for the year 1940–41.

In addition to teaching agricultural economics to B.Sc. (Agri.) students and to short course students if admitted latter the following would be attended to during the year :—

(1) To start collecting data with a view to studying the economics of betelnut industry and the allied crops in Kanara, the necessary funds for which are already sanctioned.

(2) To ascertain the effects of combination of all possible improvements suggested by the Agricultural Department on cultivators' farms, a scheme for which is submitted to the Director of Agriculture, Bombay Province, Poona, for approval.

(3) To take up investigation in the fodder supply to the Poona market from the surrounding villages with a view to making suggestions to the cultivators of the fodder supplying villages to take to dairying and subsidiary occupation if approved by the Director.

(4) To continue compilation of data collected for the farm costing and farm family budgets studies with a view to making useful and instructive publications.

College of Agriculture, : M. B. GHATGE,
Poona, 13th July 1940. Professor of Agricultural Economics.

APPENDIX M.

Summary of work done under the Professor of Agricultural Engineering, Physics and Mathematics, Agricultural College, Poona, for the year 1939-40.

Administration.

Professor J. P. Trivedi was in charge of the section up to 3rd January 1940, after which date I was in charge during the year under report. The section attends to the teaching duties at the College, Research on Soil Erosion and District inquiries and advice on Land Development.

Staff.

The staff consists of two assistants—a Lecturer and a Demonstrator, both in the upper subordinate service. A laboratory assistant attends to the laboratory work and clerical duties. During the year under report the Director of Agriculture kindly sanctioned a temporary clerk for the section for five months from October 1939 to February 1940, to cope with the increased work, due to increase in office work and the Bunding classes. Subsequently the Director of Agriculture has renewed the post from 1st May 1940 for six months.

I. THE COLLEGE TEACHING.

(A) Two subjects (1) Physics and Mathematics, (2) Agricultural Engineering, together with their laboratory and field work, are taught by this section to the Agricultural students. The students did well in both the subjects at the University Examination held in March 1940.

Physics and Mathematics.

Class.	Number appeared.	Number passed.	Percentage passed or exempted.
F. Y. Sc. (Agri.)	88	78	88·6

Agricultural Engineering.

Class.	Number appeared.	Number passed.	Percentage passed or exempted.
S. Y. Sc. (Agri.)	66	63	95·4

(B) The subject of Physics, Surveying and levelling and drawing, both in theory and in practicals and field work are taught by the section to the Forestry Ranger students of the College.

II. RESEARCH.

Levels for the Research Schemes on hand for this year have been taken. The record is maintained and the results will be worked up.

1. Study of Soil Erosion.

(*i*) 30 *Acre plot near Chatursingi hill.*—There were three days of comparatively heavy rainfall in July, one day in August followed by light showers till the end of August. The whole of September was rather dry with a few light showers till about the middle of October. The plots were ploughed this year.

Statement showing silt collected in the trenches below the sub-plots.

Period.	Silt collected per plot.			
	4 guntha plot.		3 guntha plot.	
	Cultivated.	Uncultivated.	Cultivated.	Uncultivated.
	lbs.	lbs.	lbs.	lbs.
1939–40 ..	284	533	208	303

The heaviest rainfall experienced this year measured 1·41″ and 1·50″ in July and 1·30″ in August 1939.

Silt at the rate of about 1¼ to 2¼ tons per acre was washed from the 4 guntha plots and about 1¼ to 1¾ tons per acre from the 3 guntha plots. The average depth of washing ranges from ·005″ to ·009″. The above figures show that erosion is in progress, although the erosion is much less than last year owing to deficient rainfall.

Rainfall Statement

Year.	Total Rainfall.	No. of rainy days	Number of days with Rainfall of.						Rainfall.					
			0·5 to 1″.		1″ to 1·5″		1·5 and above							
			June to Aug.	Sep. to Oct.	June to Aug.	Sep. to Oct.	June to Aug.	Sep. to Oct.	June	July	August	September	October	November
1937–38 ..	30·38	89	8	4	..	..	2	2	5·85	5·84	1·16	12·50	2·68	0·00
1938–39 ..	38·31	94	11	3	3	1	3	1	5·86	7·36	3·37	11·33	7·87	0·12
1939–40 ..	15·46	64	4	2	3	..	..	..	0·83	7·54	3·49	0·72	2·11	0·11

(*ii*) *Erosion in Gullys.*—Two gullys under observation in the plot show the continuity of erosion of bed and banks.

(*iii*) *Lines on steep and moderate grades.*—These continue to show a slight degree of further erosion.

2. KATRAJ VALLEY TERRACE OBSERVATIONS.

There is slight silt filling in some of the terraces.

3. DIVAGHAT AREA OBSERVATIONS.

Here also dry stone bunds put up across the gullys have shown slight silt filling as in the past. The filling in the large bund put up across a gully is not appreciable due to want of rainfall. Some of the bunds which were breached last year have been repaired.

4 and 5. KARJAT AND PASHAN VALLEY TERRACES.

Both the lines are under observation.

III. ADVISORY WORK AND PROPAGANDA.

The following work was attended to in several places of the Bombay Province.

(1) NORTHERN DIVISION.

(*i*) *Ahmedabad District.*—Places in Prantij and Modasa Talukas were visited with a view to study the erosion conditions and Kotar formation.

(*ii*) *Kaira District.*—At the suggestion of the Registrar, Co-operative Societies and Director, Rural Development, the estate of Thakore Devisinghji Thakhatsinghji at Bhanpura, Kaira District, was visited to investigate the question of Development and protection of land in the above area cut up by gullys and Kotars. A report with the necessary suggestions of improvement was sent to the Registrar, Co-operative Societies and Director, Rural Development.

At the suggestion of the Collector of Kaira the possibility of preventing further damage to Kotars in the Kaira District by growing trees etc. and stoppage of further formation of Kotars was gone into. A general preliminary survey of Kotars in the Nadiad, Anand and Thasra Talukas was made and suggestions for the lines of work to tackle the problem were reported.

(*iii*) *West Khandesh District.*—As desired by the Rural Development Inspector, Dhulia, the area of Ananda Ramji Patil and others previously surveyed was visited and advice about the construction of waste-weir was given.

(2) SOUTHERN DIVISION.

Ahmednagar, Sholapur and Bijapur Districts.—The erosion conditions in the above three districts were observed and the Land Development measures in the locality were inspected.

IV. CLASSES.

(1) *Advanced Bunding Class.*—An intensive Bunding class was held at the Agricultural College, Poona, for 2½ months from 16th November 1939 to 31st January 1940. 20 cultivator students recommended by the Rural Development Department and District Congress Committees were selected for the class as under :—

5 from Gujarati speaking Districts.
10 from Marathi speaking Districts.
5 from Kannada speaking Districts.

Most of them were young men of 17 to 27 years of age with the exception of one who was 33 years old. They were lodged in a house very close to the College. The sanitation was looked after and was satisfactory.

The students worked from 8 to 11-30 a.m. and 2-30 to 5-30 p.m. The attendance was regular.

The students worked in 4 batches under an Agricultural Overseer, Mr. P. B. Paranjape, B.Sc. (Agri.) who was appointed for the purpose. Three Kamgars were also appointed to assist the Agricultural Overseer in conducting the practical work, out of which one left after 15 days.

The students were given good practice in field work and surveying and levelling exercises as per detailed programme previously prepared. They surveyed an area of about 42 acres at the College and 10 acres at the Chatursingi plot. The technique of bunding and waste-weir construction was fully gone into and the students actually put up bunds and waste-weirs in the College area.

The students were taken round on a week's tour to see the important schemes and problems on bunding and erosion in Nasik, Ahmednagar, and Poona Districts.

They did well in their tests and the final examination.

In addition the students had extra class training in P. T., Scout games, First Aid, general sanitary and other information by way of magic lantern slides and they visited places of general and Agricultural interest round about on Sundays.

(2) The inspection of the district Bunding Classes was not taken up during the year as the classes were transferred to the Rural Development Department.

Corruption.

Proper supervision is maintained to see that there is no corruption in this section and there is no case of corruption to report during the year.

A. A. VASAVADA,
Professor of Agricultural Engineering,
Physics and Mathematics.

College of Agriculture,
Poona, 13th July 1940.

Programme of work under the Professor of Agricultural Engineering, Physics and Mathematics, Poona, for the year 1940–41.

The following will be taken up during the year :—

(1) Further observations on the Erosion plots near the College and Bunding and other preventive measures.

(2) Diva Ghat Forest Area-observing effect of erosion and Bunding and gully erosion prevention.

(3) Observations in Katraj Valley.

(4) and (5) Observations in the Pashan Valley and Karjat Rice terraces.

(6) Visits and advisory work in the District for land development.

(7) Conducting three months advanced Bunding classes at Poona.

(8) Proposed Research and other items of investigation and execution that would be sanctioned during the year.

A. A. VASAVADA,
Professor of Agricultural Engineering,
Physics and Mathematics.

College of Agriculture,
Poona, 13th July 1940.

APPENDIX N.

Summary of work done under the Professor of Entomology, Agricultural College, Poona, for the year 1939–40.

Administration.

During the year under report Dr. V. G. Deshpande was in charge of this section. Dr. Uppal the Plant Pathologist to Government was in charge of the section from 3rd October to 3rd November 1939 as Dr. Deshpande was on leave. Mr. S. V. Pingle, B.Sc. (Agri.), has been taken up in place of Mr. G. A. Patel, B.Sc. (Agri.), who left for higher studies in Entomology to America since 23rd December 1939.

Work.

The work done by this section is divided under the following heads :—

(*i*) Education.

(*ii*) Research on important insect pests.

(*iii*) Advisory work.

(*iv*) Service to the public.

(*i*) *Education.*

This section has to teach two subjects—Zoology to the first year students and Entomology to the final year students. From this year more attention is paid to field practicals.

One post graduate student admitted in 1937 finished work and is to submit his Thesis to the University.

(*ii*) *Research.*

1. Experiments and demonstrations of sulphur dusting against mango hoppers.
2. Study of the grasshoppers pest in the Belapur area.
3. Study of fruit flies.
4. Control of hoppers on fig.
5. Betelvine Bug.
6. Grapevine Beetle.
7. Lang Pod borer.
8. Trials of insecticides.

1. *Experiments and demonstrations of sulphur dusting against mango hoppers.*—According to the programme laid down demonstrations with the control methods of application of sulphur in the preflowering stage were conducted at Chembur (Bombay suburb), Bulsar and Surat in South Gujarat.

As the last year's trials with sulphur cyanogas mixture did not show any decided advantage it was discontinued this year.

The dusting work in Gujarat and Bombay suburb extended over 2 months.

In Gujarat 5 to 6 dustings and in Bombay suburbs 8 dustings were given. In Gujarat the pest was kept under control by repeated dustings. In Bombay suburban area due to the prevalence of cloudy weather and slight showers the pest increased to a great extent and also brought with it the sooty mould. To bring it under control the interval between two dustings was reduced from 10 days to 7 days but in spite of this the pest could not be completely controlled due to the prevalence of suitable weather for the development of the pest. However the bearing in treated garden was better than in untreated garden. The following statement will indicate the condition of untreated gardens.

Statement I.

Number of hoppers on 20 inflorescences of treated trees.	Number of hoppers on 20 inflorescences of untreated trees.
700	4,000 to 5,000

2. *Grasshopper pest in Belapur Area.*—This work was managed by the Divisional Superintendent Deccan canals, Belapur Road. From the trials and observations of the last year the following preventive and control measures were tried and were found satisfactory to control the pest:—

(*i*) Ploughing the infected area especially along the bunds and exposing the eggs masses to the action of the sun.

(*ii*) Keeping the field boundaries of the surrounding area clean by digging or ploughing.

Control measures—

(*i*) Controlling the pest in its initial stage by spraying of crude oil along the bunds when it appears there.

(*ii*) When the pest enters the field giving crude oil with irrigation water and then beating down the pest in this water.

(*iii*) By holding stretchers besmeared with molasses in between the rows and then shaking the plants so as to drop the hoppers on the stretchers.

(*iv*) The adult insects can be hand picked with the help of a light and killed.

General observations.

1. The pest appears first along the bunds or in the neighbouring fallow fields.
2. Antimonsoon showers, hot weather irrigated cotton and jowar fodder fields and ratoon crop fields form a great source of infection.

3. *Fruit flies.*—The collection of fruit flies on mango, guava citrus was continued through out the year by trapping them with clensel. The flies were caught throughout the year and it confirms the previous results.

The following statements show the distribution of flies during the year under report.

Statement II.

Mango.		Guava.		Citrus.		Variety of fruit flies.
Male.	Female.	Male.	Female.	Male.	Female.	
210	71	48	11	12	1	Chaetodacus ferrugineus.
261	76	18	9	9	8	Do. Zonatus.
46	22	16	19	3	3	Do. Correctus.
81	31	21	5	17	2	Do. diversus.
14	6	5	2	3	1	Do. Cucurbitae.
612	206	108	46	44	15	Total No. of flies.

Statement III.

Number of traps on mango-tree.	Number of traps on guava trees.	Number of traps on citrus trees.
20	10	10

From the above results it will be seen that the number of trapped flies is always the largest on mango trees. During the year under report poison baits were tried in conjunction with trapping but the results are not still conclusive and hence the trials will be continued during the next year.

4. *Fig Hoppers.*—To control the hoppers a spraying of nicotine sulphate was given but as it caused the yellowing and then shedding of tender leaves the work had to be stopped for the year in question. However it will be continued next year and other insecticides will be tried.

5. *Betelvine Bug (Scheme)—Disphinctus maesarum.*—The year under report is the third year of the scheme financed by the Sir Sassoon David Trust Funds. The scheme is under my control and guidance.

According to the programme laid down the control methods were tried and among the various insecticides tried Fish oil rosin soap was found to be cheaper and more effective in controlling the pest. The cost of treatment varies from Rs. 6 to 12 per acre according to the growth of the vines. The trials with different insecticides will be continued further and it will be ascertained which is the best and the cheapest control method.

6. *Grapevine Beetle-Scheme.*—The scheme for the study of life history of this pest and the control methods for it was started this year under my control and guidance. The scheme is financed from Sir Sassoon David Trust Fund.

Life history of the pest is nearly established and consists of 38 to 55 days. Feeding habits are also studied and it is found that the damage caused by beetles will be serious during the prunned period when they feed on buds as a result of which bleeding starts.

A study of the life history, habits and control methods constitute the programme for the next year.

7. *Lang pod borer.*—As the pest did not occur the work was not carried out. If the pest occurs during the next year it will be continued.

8. *Trials of insecticides.*—The following insecticides were tried by this section during the year under report.

Statement IV.

Name of the Insecticide.	Insect pest against which it was tried.	Remarks.
1. Acme Emo Emulsion ..	Aphis and thrips ..	It was tried in comparison with nicotin sulphate and was found to give 80 per cent. kill.
2. Pelticide	Betelvine bug ..	Not effective.

(iii) Advisory work.

A large number of inquiries on insect pests were received as usual during the year under report and they were all complied with promptly. This year number shows an increase over that of the last year. This shows that the work of this section is increasing though this part of the work has been transferred to Rural Development Department.

The Professor of Entomology toured during the year for 54 days and visited 68 places for advisory and investigation work. The lecturer toured for 72 days and visited 36 places.

In addition to this touring was done by other staff members of this section in connection with demonstration trials of mango hoppers at various centres.

Besides this the Professor of Entomology attended 12 meetings of Insect Pest and Plant Disease Committee and discussed various problems with the members of the committee.

Service to the public.—During the year under report a large number of demands was received from Agricultural officers and various institutions from this Province and outside the Province regarding the supply of information, advice, silk worms, insect pests, etc. All these were complied with.

Lastly I would like to remark that all the members of the staff of my section worked satisfactorily, and I may add that the Director of Agriculture has sanctioned under the delegation powers a clerk for this section recently. This will now much facilitate the work and it is hoped that the post will be made permanent.

Proper supervision is maintained to see that there is no corruption in this section and there is no case of corruption during the year under report.

B. S. PATEL,
Professor of Entomology,
College of Agriculture, Poona.

College of Agriculture,
Poona, 16th July 1940.

Programme of work for the year 1940–41.

I. Demonstration trials of Sulphur dusting against mango hoppers.

II. Observation on fig hoppers, to ascertain the cause of curling leaves and their other habits.

III. Demonstration trials to control the grasshopper pest in the Belapur area.

IV. Fruit flies—

An attempt will be made to try the effect of the Poison baiting along with trapping.

V. Betelvine Bug (Scheme financed by The Sir Sassoon David Trust Fund).

VI. Grape vine Beetle (Do.).

VII. Trials of insecticides.

APPENDIX O.

Summary of work done under the Officer in charge of Research Work in Apiculture, Ganeshkhind Fruit Experiment Station, Kirkee, for the year 1939–40.

The year under report was the 2nd year since the beginning of the scheme. The programme of work for the year was as below :—

1. Continuation of the survey work.

2. Further studies on the research items of the previous year :—

   (*a*) Experiments with Apis-dorsata.

   (*b*) Artificial feeding of bees.

   (*c*) Bee-pasturage.

3. Settling of more number of colonies of Apis-indica from various centres for comparative study on the honey yield and behaviour.

4. Observations on Bee-enemies and diseases.

5. Training of students.

6. Advisory.

1. *Continuation of the survey work.*—Survey work of ascertaining the distribution of bees was continued in the districts of Nasik, Satara, Ratnagiri and Belgaum. A map illustrating the distribution of wild bees in the province both Apis-indica and Apis-dorsata was prepared and submitted.

2. (*a*) *Experiments with Apis-dorsata.*—Out of the four frames fixed at Moorsavar Mutt, Hubli for the purpose of attracting the Rock-bees, two frames were found occupied by bees during November 1939—two colonies in each frame ; one colony within the frame while the other down below it. Repeated handling of the frames on which the colonies had settled was done and the bees were found to be as docile as the hive bees at all times. It required cautious and gentle handling. Temperature reading of a few brood combs was taken and it was found that the temperature varied from comb to comb from 86 to 92 degrees F. while the outside temperature being 76 degrees F. at the time of observation. The combs that showed temperature ranging from 90 to 92 degrees F. had brisk brood rearing activities while others that showed lower temperatures had correspondingly less of brood rearing activities. In the case of hive bees it has been observed that the temperature scale rose between 95 and 97 degrees F. at the time of brisk brood rearing. The temperature reading of the combs was taken just to ascertain the exact temperature at which the two different types of bees reared their brood and to study the reactions of eggs and larvae of the Rock-bees when grafted to an Apis-indica colony.

Methods for the collection of honey from the Rock-bee combs without disturbing their brood are under study. Small sections will be fixed to main frames which could be removed after getting them filled with honey. This work will be undertaken soon after the monsoon at Hubli when large number of swarms are expected at convenient locations.

An attempt to rear some queens from the eggs of the Rock-bees was made by grafting a piece of Rock-bee comb containing 40 eggs to a queenless colony of Apis-indica which was deprived of its brood. In three days' time the bees constructed one queen cell with a tiny larva inside but after five days it was found missing from the cell. Further experiments on this item are necessary and will be continued.

(*b*) *Artificial feeding of bees.*—During the period under report artificial feeding was resorted to for settling the newly captured colonies. Gul syrup prepared fresh every time in the ratio two of gul and three of water was served to colonies and the colonies were found to consume it readily and settle down. Colonies took two to five weeks' time to settle down and consumed one to three pounds of gul. The cost of feeding per colony was from 0–1–6 to 0–4–6 according to the quantity and duration of feeding. During the first half of May, six colonies were put under a stimulative feeding treatment for a period of nine days. The total quantity fed to each colony was about 1 lb. 12 oz. of gul, the relative cost being 0–2–9. Four of them responded to the treatment exhibiting expansion of their brood, combs and storage; with the result, two of them got back to their normal strength (as they were divided into two more colonies before feeding) while one progressed well and gave 1 lb. 6 oz. of honey and the other showed gradual progress in breeding.

A colony in which the queen has stopped laying for a month was brought back to its normal conditions by treating it with a little of pollen obtained from a Rock-bee comb and made into a paste with honey. As the bees consumed the feeding, the queen started laying and the workers resumed their collection of pollen. The feeding was discontinued when the bees started their normal work.

(*c*) *Bee-pasturage.*—In addition to the 74 plants noted in the last year, 31 more plants were noted to have attracted bees and they have been classified according to their flowering season, locality, pollen and nectar yield, relation to particular kind of bees etc. Out of them the following were observed to be of good source:—Salvia plebia, Bombax Malabaricum, Terminalia Chebula, Anacardium occidentale, Butea frondosa and Balsam. Besides, the bees were observed to visit the leaf glands of Terminalia tomentosa for nestar during the months of May and June.

3. Settling of more number of colonies of Apis-indica :—

Table showing the progress of colonies.

Year.	Number of colonies brought for trial.	Number of colonies got settled.	Number of colonies that yielded honey.	Quantity yielded.	Remarks.
1938–39 ..	36	13	6	4 lbs. 6 oz.	Maximum yield from a colony was 1 lb. 2 oz.
1939–1940 ..	47	21	12	22 lbs. 14 oz.	Maximum yield from a colony was 9 lb.

Out of the 47 colonies brought for trial six came from Tiruchengodu, South India, in October 1939. Five of them being weak were united with other bees. The remaining one progressed well and gave 6 oz. of honey and one more colony. The parental colony was requeened in December and it is to be noted that the new queen had the mating with a local drone and since then the colony rapidly grew in strength which could be divided in the month of March 1940. The division made was also progressing satisfactorily.

The remaining 41 colonies were obtained from the following places :—

30 from Poona, and its surroundings ; 5 from Nandgad (Belgaum) ; 2 from Mahabaleshwar ; and 4 from Mulher (Nasik). Out of these 19 got deserted being unsettled and 8 had to be united with other bees being weak. Out of the remaining colonies 4 more divisions could be obtained making a total number of 19 working colonies. In the course of the year, 10 colonies of the current year and two of the previous year, belonging to the local type yielded 21 lbs. 8 oz. of honey. The average cost of feeding a colony per month was found to be an anna. Other observations made on their behaviour were :—

50 per cent. of the local colonies left their queens behind when they deserted due to disturbance caused by adjucent colonies. About 20 per cent. of them did so leaving behind healthy brood. These two acts were contrary to their nature. The local bees were found to be persistent in robbing weaker colonies during the slack season.

As certain colonies showed much progress, an attempt was made to multiply their breed and three colonies were obtained with new queens from them. The divisions obtained were found progressing.

4. *Observations on Bee-enemies and diseases.*—The following bee-enemies were noticed during the period under report:—

(1) Wax-moth, (2) Black ant; (3) Blood-sucker, (4) Bee-eater, (5) King-crow, (6) Lizzard, (7) Yellow banded wasp, (8) Spiders of various kinds, (9) Pseudo scorpions, (10) Bee-louse, (11) Mites and other insects.

The nature of harm done by each enemy to a bee colony was studied as also the locality in which each was found together with the seasons in which each of them paid their visits were noted. It was observed that the most serious enemy of the bees in this province was wax-moth and it was found distributed throughout the province in all seasons. During the months of July and August the trouble from these moths was at its height.

Under Bee-diseases mention may be made about a kind of disease of adult bees—Nosema Apis accompanied by symptoms of paralysis noticed during the accompanied by symptoms of paralysis notice during the course of settling the colonies. During June–August 1939, nine colonies were found affected. The maximum number of days under which the colonies showed the affected symptoms were fifteen with a maximum number of 734 deaths in one colony. The bees were seen coming out of the hives with trembling movements and spread out wings and dying after a little struggle near the hive. During May–June 1940, 21 colonies were found affected slightly with the same trouble. In this, the maximum deaths were 278 while the maximum number of days of the trouble were 26. The affected colonies were treated as follows and the colonies gradually recovered. The body of the infected hives was washed with Potassium Permanganate solution daily in the morning and in addition the hives of the weaker colonies were covered with gunny bags so as to supply the bees with more warmth.

A mild attack of brood disease was also noticed in four colonies of the local type of bees during the months of June, July and August 1939. By the appearance of the bright season it gradually disappeared.

Another trouble which was noticed during the monsoon was the Fungus growth on combs. Generally old combs were found affected and when they were removed the trouble seemed to lessen and by the appearance of the bright season it disappeared.

5. *Training of students.*—A special class was conducted for a period of six weeks during October-November 1939 when 79 students of the Horticultural class attended. Further, training to three students from North Kanara was given during February to April 1940, the period being three months.

6. *Advisory.*—One hundred and three enquiries regarding the supply of information on the subject such as, Bee-literature, Bee-appliances, identification of bees, places suitable for starting the industry, clarification of honey etc. were replied during the course of the year under report. The number of people who keep bees got increased during this year chiefly in North-Kanara, Belgaum, Mahabaleshwar and Thana.

A leaflet containing simple practical instructions for bee-keepers in the province and containing a section giving the economic aspects of the Bee-keeping industry when adopted in the villages on a small scale was prepared and submitted.

If the scheme is continued, the following programme will be undertaken :—

(1) Continuation of experiments with the Rock-bees.

(2) Economics of Bee-keeping.

(3) Further studies on enemies and diseases.

(4) Trials with Northern Indian bees.

(5) Training of students.

(6) Advisory work as usual.

H. VISWANATHAN,
Officer in Charge,
Research Work in Apiculture.

List of Agricultural Bulletins published by the Department of Agriculture and kept for sale at the Government Book Depot, Bombay

[*N.B.*—Bulletins marked in asterisk are out of stock and not available for the present.]

No.	Year.	*Subject.*	Price. Rs. a. p.
32	1908	Locusts in India, by H. M. Lefroy, Imperial Entomologist, Pusa ..	0 8 0
33	1909	Cultivation of Broach Cotton in Dharwar, by M. L. Kulkarni, Divisional Inspector of Agriculture, S. D. ..	0 4 0
34	1909	Night-soil—A Valuable Manure, by G. K. Kelkar, Assistant Professor of Agriculture, Agricultural College, Poona ..	0 4 0
36	1910	First Experiments in the Treatment of Grape-Vine Mildew in the Bombay Presidency, by W. Burns, Economic Botanist ..	0 14 0
37	1910	An Examination of the Seed-Supply of the Broach District, by G. D. Mehta ..	0 4 0
*39	1910	The Salt Lands of the Nira Valley, by Harold H. Mann, Principal, Agricultural College, Poona, and V. A. Tamhane, Laboratory Assistant, Agricultural College, Poona ..	0 5 0
*40	1911	The Cultivation of Guavas near Poona, Dharwar and Limbgaon ..	0 12 0
*41	1911	Groundnuts in the Bombay Deccan ..	0 4 0
43	1911	An Examination of the Seed-Supply of the Broach District, Part II ..	0 5 0
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45	1911	Second Year's Experiments in the Treatment of Grape-Vine Mildew in the Bombay Presidency ..	0 14 0
46	1911	Seed Selections Series I, Broach Cotton ..	0 8 0
47	1911	San Hemp ..	0 4 0
48	1911	Poona Furnace ..	0 7 0
		Do. (Marathi) ..	0 6 0
49	1911	An Examination of the Seed-Supply of the Ahmednagar District, Part I ..	0 5 0
50	1912	An Examination of the Seed-Supply of the Ahmednagar District, Part II ..	0 3 0
51	1912	Third Year's Experiments in the Treatment of Grape-Vine Mildew ..	0 3 0
52	1912	Muscovado Sugar Machinery and its scope for Gul Manufacture in India ..	0 8 0
*53	1912	A Method of Improving the Quality of Cotton Seed ..	0 7 0
*55	1913	An Examination of the Seed-Supply of the Poona District ..	0 3 0
57	1913	Improvement of the Indigenous Plough of Western India ..	0 12 0
*59	1914	Common Salt and its Use as Manure in the Konkan Division .	0 3 0
*62	1914	The Value of Castration of Deccan Bullocks ..	0 3 0
*63	1914	Substitute for Rab ..	0 3 0
*65	1914	A List of Diseases of Economic Plants occurring in the Bombay Presidency ...	0 4 0

No.	Year.	Subject.	Price. Rs. a. p.
67	1914	An Examination of the Seed-Supply of the Sholapur District ..	0 3 0
*69	1915	The Rice Stem Borer in the Konkan ..	0 3 6
*70	1915	Improvement of Cotton in the Bombay Presidency (except Sind) ..	0 3 6
*74	1915	Well Waters from the Trap Area of Western India ..	0 6 0
*79	1916	The Cultivation of Guavas in Gujarat ..	0 5 6
80	1916	List of Seeds available on the Agricultural College Farm, Poona ..	0 5 3
*81	1916	Note on Fencing Construction ..	0 6 9
82	1916	Cultivation of Drilled Paddy in South Bombay Presidency ..	0 8 0
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87	1918	The Utilisation of Inferior Grass Herbage, Experiments at the Tegur Cattle Farm ..	0 9 0
*90	1918	Work on the Manjri Farm for the years 1915–18 ..	0 7 3
92	1919	Classification and Description of the Jowars of the Bombay-Karnatak ..	0 10 3
93	1919	Palm Gul Manufacture in the Bombay Presidency (principally Date Palm) ..	1 3 9
*94	1919	The Sugarcane Borer and its Control ..	0 4 3
97	1920	Prickly-Pear as a Cattle Food ..	1 4 0
*100	1920	Fodder Crops of Western India ..	2 1 0
101	1920	Fruit Culture in Palitana and Jamnagar ..	0 8 6
102	1920	Investigations on Potato Cultivation in Western India ..	1 15 0
103	1920	The Book of the Mango ..	3 5 0
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104	1920	The Ganeshkhind Botanical Garden, Kirkee (Its Genesis and Development) ..	0 15 6
105	1920	The Groundnut Bug and its Control ..	0 2 0
106	1920	Dharwar American Cotton: Its History, Cultivation and Improvement ..	0 7 0
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119	1924	Year Book of the Agricultural Department in Southern Division, 1924 ..	0 4 6
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121	1924	Further Investigation on Potato ..	0 6 0

No.	Year.	Subject.	Price. Rs. a. p.
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124	1925	The Chemical Composition of Food-grain Vegetables and Fruits of Western India ..	0 3 6
125	1925	Some of the promising Exotic Sugarcane Varieties of the Manjri Farm ..	0 13 0
127	1926	Elephant Grass—a new and useful Fodder Crop in Western India ..	0 1 0
129	1926	The Treatment of Patches of Inferior Tobacco in Northern Gujarat ..	0 1 6
130	1926	Some useful Forest Trees and Shrubs of the Coastal Tract and their Fodder Value ..	0 8 0
131	1926	The Fig Industry of Asia Minor ..	0 4 6
132	1926	The Improvement of Tobacco in Northern Gujarat ..	0 4 0
133	1926	Work of the Ganeshkhind Botanical Gardens and Modibag Garden in 1921–25 ..	0 2 0
135	1927	An Improved Method of Growing Turmeric in the Deccan ..	0 4 0
*136	1927	Cattle Breeding in the Bombay Presidency, Principles and Progress ..	0 5 6
137	1927	Notes on the Lemon Industry in Italy ..	0 2 0
139	1927	Sugarcane Mills and small power Crushers in the Bombay Presidency ..	0 6 6
140	1927	Tobacco Cultivation in the Southern Maratha Country ..	0 3 0
141	1927	Trees and Shrubs for producing Green Manure in the Konkan and North Kanara ..	0 3 0
142	1927	Dry Farming Methods in the Deccan ..	0 6 9
*143	1927	Experiments on Cotton Manuring in Khandesh ..	0 1 3
144	1927	Furnaces for making Gul or Crude Sugar in the Bombay Presidency ..	0 7 3
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*148	1927	Culture of Guava and its Improvement by Selection in Western India ..	0 7 3
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154	1928	Assimilation of Nutrients by the Rice Plant (Technical series) ..	0 5 0
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*156	1928	Grape Culture in Western India ..	0 7 0
157	1929	Study of the Soils Associated with the Deterioration of the Cardamom Crop in North Kanara ..	0 3 0

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No.	Year.	Subject.	Price. Rs. a. p.
*158	1929	Preliminary Note on the Possibilities of the Development of Lemon Industry in Western India ..	0 2 0
*160	1929	Soils of the Bombay Presidency ..	0 7 0
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162	1930	Popaya Cultivation in the Bombay Presidency ..	0 3 0
163	1930	Powdery Mildew of the Grape and its Control in Bombay ..	0 3 0
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165	1930	The Frost of January 1929 and its Damage to Crops of the Bombay Presidency ..	0 6 0
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168	1932	Preliminary Studies of important Crops in the Bombay Deccan in the Post-war Period ..	0 10 0
169	1932	Cumin Powdery Mildew in Bombay ..	0 3 0
170	1932	Report on the Export of Mango to Europe in 1932 ..	0 11 0
171	1932	Grassland Problems in Western India ..	0 3 0
172	1933	Summaries of the Annual Reports of the Experimental Work done under the Economic Botanist from 1893 to 1916 ..	0 2 0
173	1933	Marketing of some Agricultural Products exported from Bombay to the United Kingdom ..	0 3 0
174	1933	Composition of important Manures and Manurial Constituents of important Crops in Western India ..	0 2 0
		Publication on "Experiments in Manuring Crops in the Bombay Presidency, 1896 to 1931" ..	2 9 0
175	1934	Manufacture of White Sugar and Gul by the Open-Pan Process ..	0 3 0
176	1934	Fungi of Bombay ..	0 12 0
177	1935	Pea Powdery Mildew in Bombay ..	0 3 0
178	1936	Improvement of Rice in the Bombay Karnatak, Part I—Selections in the Mugad and Antarsal Varieties of Paddy ..	0 3 0
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181	1938	Improvement of Ratnagiri Rices by Breeding ..	0 4 0
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